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# Navigating the Future: Industry 4.0 Adoption in Accounting Through the Toe Framework

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**Abstract:**

The rapid advancement of Industry 4.0 technologies is transforming the accounting profession, necessitating the integration of artificial intelligence, blockchain, big data analytics, and cloud computing. However, the adoption of these technologies remains inconsistent due to challenges related to technological compatibility, organisational readiness, and regulatory constraints. This study explores the factors influencing Industry 4.0 adoption in accounting using the Technology-Organisation-Environment (TOE) framework. A qualitative research approach was employed, with semi-structured interviews conducted with 13 accounting professionals in managerial and leadership roles. Thematic analysis was used to identify key determinants of adoption, including perceived benefits, financial resources, digital trust, competitive pressure, and regulatory support. The findings reveal that successful adoption depends on aligning new technologies with existing systems, leveraging automation for enhanced efficiency, and adapting to the evolving role of accounting professionals. Additionally, Industry 4.0 is redefining traditional accounting functions, shifting the focus towards strategic decision-making and advisory roles. While adoption challenges persist, particularly for smaller firms with limited resources, strong leadership and investment in workforce development are critical to navigating digital transformation. These insights offer practical implications for accounting professionals, firms, educators, and policymakers aiming to facilitate the seamless integration of Industry 4.0 technologies into accounting practices.

**Keywords:**

Accounting, Digital Transformation, Industry 4.0, Technology Adoption, TOE Framework

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# Introduction

Industry 4.0 signifies a paradigm shift in business operations through the integration of technologies such as cyber-physical systems (CPS), the Internet of Things (IoT), artificial intelligence (AI), big data analytics, cloud computing, and smart factories. These technologies enhance efficiency, adaptability, and decision-making processes across sectors, including accounting and finance. As organisations adopt these technologies, accounting professionals must navigate evolving demands that redefine their roles and competencies. The accounting profession is transitioning from traditional record-keeping and compliance tasks to strategic functions that require technological literacy and analytical acumen. This paper examines the factors influencing the adoption of Industry 4.0 technologies within the accounting profession using the Technology-Organisation-Environment (TOE) framework.

## Background

Cyber-physical systems are the foundation of Industry 4.0 because they enable real-time data transmission between physical and digital systems. Cyber-physical systems enable the creation of smart factories, where machines, sensors, and software interact seamlessly to optimise production processes (Sinha & Roy, 2020; Hughes et al., 2020). For example, CPS can predict maintenance requirements and monitor the condition of equipment, which lowers operational costs and downtime (Li, 2023). Similarly, the IoT enhances this connectivity by integrating devices and systems, enabling extensive data collection and analysis. This interconnected environment allows for predictive analytics, improved decision-making and operational efficiency (Xing et al., 2019; Ali & Xie, 2021). These advancements in data processing and integration are directly relevant to accounting, as they enable the real-time monitoring of financial performance and the automation of routine accounting tasks.

Artificial intelligence and big data analytics are essential in transforming the vast amounts of data IoT devices generate into actionable insights. Artificial intelligence algorithms can identify patterns and trends, leading to enhanced decision-making in financial performance evaluation and customer satisfaction through personalised services (Sarker, 2021; Li et al., 2023). In accounting, big data analytics has revolutionised the profession by enabling the processing of large datasets, including structured and unstructured data. Big data analytics capability provides deeper insights into financial trends and operational efficiency, improving the quality of financial reporting (Franke & Hiebl, 2022; Wang, 2023). Moreover, McBride and Philippou (2021) emphasise that data analytics enhances decision-making by delivering relevant financial information to stakeholders. However, Damayanti (2019) indicates that traditional accounting frameworks such as Generally Accepted Accounting Principles (GAAP) face challenges in accommodating the dynamic nature of big data, which includes diverse data types like audio, video, and social media content. This necessitates reevaluating

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accounting standards and practices to ensure alignment with the complexities introduced by modern data realities. Al-Htaybat and Alberti-Alhtaybat (2017) highlight the paradoxes in corporate reporting caused by big data, stressing the need for innovative approaches to bridge the gap between traditional accounting practices and contemporary data demands.

Cloud computing plays a fundamental role in Industry 4.0 by providing scalable resources that facilitate the storage, processing, and analysis of large datasets. For accounting, Cloud computing technology enhances the efficiency of information systems by clustering and analysing extensive data, leading to faster and more accurate financial reporting (Lv et al., 2018; Zhang, 2022). Cloud technology also promotes collaboration across geographically dispersed teams, streamlining financial processes and decision-making. However, its adoption introduces challenges related to data security, governance, and compliance, particularly in industries with stringent regulatory requirements (Wang et al., 2015; Li, 2023; Adnan, 2024). Accountants must carefully navigate these challenges to harness the full potential of cloud-based systems. The integration of cloud computing represents a fundamental shift in how financial data is managed, underscoring the evolving role of accountants in a data-driven environment.

The concept of smart factories encapsulates the essence of Industry 4.0, merging automation and data exchange to create highly efficient production environments. Smart factories leverage technologies such as machine-to-machine communication, robotics, and advanced sensors to streamline operations and reduce human intervention (Godina et al., 2020). Smart factories also generate real-time data that can be integrated into accounting systems for better cost estimation, inventory management, and performance analysis. For example, Radio Frequency Identification (RFID) chips and location-based data enable precise inventory tracking and valuation, which accountants can use to optimise supply chain and financial operations. However, adopting smart factory technologies requires significant investments in infrastructure and training, posing challenges that accountants must account for in strategic decision-making and cost analysis (Bagherian et al., 2024). Organisations must navigate the complexities of integrating new technologies with legacy systems, which can lead to significant disruptions if not managed carefully (Marešová et al., 2018).

These technological advancements also influence the educational landscape for future accountants. As the profession adapts to the demands of Industry 4.0, educational institutions must incorporate data analytics, cloud computing, and big data competencies into accounting curricula (Sufian et al., 2023). Handoyo (2024) highlights the pressing need for innovative educational models that prepare students for the realities of modern accounting, ensuring they are equipped with the skills to leverage advanced technologies effectively. This educational shift is critical for maintaining the relevance and adaptability of the accounting profession in a rapidly evolving technological landscape.

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Despite the increasing integration of Industry 4.0 technologies across various industries, the accounting profession faces challenges in fully adopting these advancements. While technologies such as artificial intelligence, big data analytics, blockchain, and cloud computing offer potential benefits, their implementation in accounting remains uneven. Factors such as technological compatibility, financial constraints, regulatory complexities, and organisational resistance hinder widespread adoption. Additionally, the evolving nature of accounting roles necessitates reskilling and redefining professional competencies to align with digital transformation. This study addresses these challenges by examining the adoption of Industry 4.0 technologies in accounting through the Technology-Organisation-Environment (TOE) framework. The study provides insights into factors affecting industry-wide digital transformation by exploring the technological, organisational, and environmental factors that influence adoption. The findings contribute to a deeper understanding of how accounting professionals and organisations can strategically navigate the transition to a technology-driven environment while mitigating associated risks and maximising opportunities.

# Literature Review

## Technology in Accounting

The advancement of technology has significantly influenced the evolution of accounting. The printing press, created by Gutenberg, was one of the first revolutionary innovations that allowed accounting concepts to be widely disseminated (Anandarajan et al., 2004). The subsequent advent of computers revolutionised accounting practices, enabling businesses to electronically record transactions (Anandarajan et al., 2004). In 1954, General Electric pioneered the use of computers in accounting for payroll and tax calculations despite the limited familiarity of accountants with computers at the time (Mason, 2004). By 1968, generalised audit software (GAS) emerged, further transforming the field (Nwachukwu et al., 2021). Computers offered distinct advantages over manual processes, such as processing large volumes of data with minimal error and presenting detailed insights unavailable to earlier generations (Devine, Srinivasan & Zaman, 2004). Additionally, computerised data enhanced controls, aiding in detecting fraudulent activities.

Modern technological advancements have shifted the role of accounting from merely reporting financial data to serving as a tool for financial analysis and effective management (Mancini, Vaassen & Dameri, 2013). Computerised systems allow for task specialisation, enabling managers to employ sophisticated performance measurement and goal-setting methods (Turner, Weickgenannt & Copeland, 2020). As a result, accountants must be proficient in both digital and manual systems. According to Kurt (2019), achieving Industry 4.0 hinges on successful digital transformation within organisations. While technology integration is not novel in accounting, the embedded nature of emerging tools has the potential to

redefine the profession (Kurt, 2019). This transformation affects how information is reported, who accesses it, and its implications for tax reporting, auditing, and advisory services (Schmitz & Leoni, 2019). Therefore, management practitioners must harness these technologies to optimise performance (Patil & Shankar, 2023). To remain competitive, workers must continually upskill in emerging technologies (Pedota et al., 2023).

## The Evolving Role of Accounting Professionals

The Industrial Revolution 4.0 is expected to render certain careers and tasks obsolete while creating roles requiring advanced technological expertise. Industry 4.0 envisions interconnected production systems that generate real-time data, allowing software and algorithms to produce instant reports (Kurt, 2019). Remote management facilitates the operation of smart factories, where minimal human intervention is required, leading to heightened productivity (Kablan, 2020). This shift alters labour relations, emphasising the strategic role of the workforce in the production paradigm. The integration of robotics and automation is anticipated to reduce reliance on unskilled labour, thereby reshaping the nature and distribution of jobs (Gotthardt et al., 2020). While some accounting professionals risk job displacement if they fail to adapt, the focus should be on evolving task requirements rather than job loss (Gonçalves et al., 2022). Therefore, aligning the workforce with new technological demands, such as robotics and automation, is important.

The primary function of accounting professionals is to collect and present data in a manner that benefits stakeholders. Historically, financial reports provide retrospective information to inform decision-making by investors, suppliers, consumers, and creditors (Edwards & Boyns, 2022). However, Industry 4.0 is transforming financial reporting through big data analytics, enhancing methods of data collection, tracking, and analysis (Oyewole et al, 2024). Big data is expected to improve accounting and reporting standards, increase transparency, and enable international consistency in financial statements (Oyewole et al, 2024). Consequently, future accounting professionals must analyse large volumes of unstructured data and derive meaningful insights for stakeholders (Bose et al, 2023).

## Real-Time Accounting and Triple-Entry Accounting

The integration of Industry 4.0 technologies is paving the way for real-time accounting. Automated data entry, remote access, and cloud-based software enable real-time processing, ensuring timely, accessible, and transparent financial information (Kablan, 2020). The accounting profession is anticipated to evolve into creative and notary roles. Notary accountants will oversee transaction verification and agreement documentation, while creative accountants will focus on evaluating internal controls and managing non-traditional operations (Hacioglu, 2020). Consequently, accountants will need

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to provide comprehensive corporate reporting that extends beyond numerical data (Schaltegger & Burritt, 2017).

The introduction of triple-entry accounting, which incorporates a third ledger into the traditional double-entry system, enhances transparency and trust by creating tamper-proof audit trails (Faccia & Mosteanu, 2019; Cai, 2021). Blockchain's shared, immutable ledger records transaction details and ensures data integrity through cryptographic security, reducing fraud and errors (Saurabh et al., 2023). The third entry in the ledger, recorded on the Blockchain, provides an independent and verifiable transaction record accessible to all parties involved (Saurabh et al., 2022). Blockchain's potential to revolutionise accounting lies in its ability to secure data and transform the reliability of financial reporting.

The incorporation of Information Systems (IS) infrastructure and Business Intelligence and Analytics (BI&A) technologies has further enhanced accounting practices, including planning, control, performance measurement, transaction processing, and reporting. These technologies facilitate improved decision-making and strategic flexibility by providing timely and accurate information (Peters et al., 2022). The alignment of IS infrastructure with strategic enterprise management practices fosters managerial debate, reinforces performance aspirations, and supports innovation (Appelbaum et al., 2022). Strong IS integration enables organisations to respond effectively to environmental changes, ultimately enhancing their strategic decision-making capacity (Appelbaum et al., 2022). Technological advancements in Industry 4.0 are reshaping the accounting profession, requiring professionals to continuously acquire new skills and adapt to emerging technologies to maintain their relevance in a rapidly evolving field.

## Technology, Organisation, and Environment (TOE) Framework

The Technology, Organisation, and Environment framework, developed by Tornatzky, Fleischer and Chakrabarti (1990), provides a comprehensive theoretical foundation for understanding technology adoption at the organisational level. This framework considers technological, organisational, and environmental as the main factors influencing an organisation's decision to adopt and implement new technologies. Its empirical support makes it a robust starting point for evaluating and identifying the key factors affecting innovation adoption (Valdebenito & Quelopana, 2019).

The TOE framework describes how the context of a firm, shaped by technological attributes, organisational characteristics, and environmental influences, impacts its technology adoption decisions (Valdebenito & Quelopana, 2019). The TOE framework is effective in providing a structured approach to analysing the determinants of technology adoption (Malik et al., 2021). Furthermore, its applicability across various organisational settings, including small businesses, demonstrates its flexibility and relevance in different contexts (Awa et al., 2017). One of the strengths of the TOE framework lies in its

ability to integrate socio-economic aspects and explore the interaction between technological advancements and organisational conditions within the context of industry environments (Malik et al., 2021). This integrative approach allows for a holistic understanding of the factors influencing technology adoption, making it a valuable tool for organisations undergoing significant business transformation.

However, critics argue that the TOE framework tends to overlook the significance of interorganisational interactions and their impact on technology adoption (Al Hadwer et al., 2021). For instance, relationships between firms, such as partnerships or supply chain dynamics, can influence decisions but may not be adequately captured by the TOE model (Nguyen et al, 2022). Furthermore, Ahmed (2020) cautions that excluding external influences, such as socio-political and economic pressures, may result in inconclusive findings. Additionally, some researchers contend that the TOE framework does not introduce a unique perspective on innovation adoption but instead aligns with and complements existing theories in the field (Nguyen et al, 2022). While this criticism highlights its lack of novelty, it also stresses the framework's adaptability and compatibility with broader innovation theories.

## Technology Context

Baker (2012) defines the technological context within the TOE framework as encompassing both existing and emerging technologies critical to business operations. During transformation processes, organisations must assess their current technological assets, as these determine the scope and speed of technological change. The integration of modern technologies often leads to significant changes in work processes, frequently met with resistance (Malik et al., 2021). Innovations offering greater advantages over existing practices are more likely to be adopted. Clifton et al. (2020) emphasise that the perceived benefits of technology, whether economic gain or social prestige, depend on its nature. For example, adopting cloud computing can lower operational costs but may face challenges related to security risks. Similarly, the perceived advantages of Industry 4.0 encourage its adoption across industries.

A firm's technological competence shapes the desire and capacity to implement new technologies. Okorie et al. (2023) propose that this competence can be measured by comparing an organisation’s information technology capabilities with those of its competitors and industry leaders. Better technological competence enhances the likelihood of adopting modern systems. This competence encompasses the firm’s technological infrastructure and the expertise of its workforce, both of which drive effective technology adoption (Gregurec et al., 2021).

Before implementing new technologies, organisations must evaluate the potential organisational changes these technologies might cause. While some technologies have minor effects on businesses, others significantly alter operations and industry practices (Woschke et al., 2017; Gregurec et al., 2021).

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Incremental innovations, such as regular security updates, introduce minor improvements to existing systems, presenting fewer risks and opportunities compared to radical innovations (Maxwell & Metz, 2021). Such innovations address immediate market needs and are vital for long-term sustainability (Clifton et al., 2020). Radical innovations, on the other hand, involve significant operational shifts and fundamentally alter organisational practices (McDermott & O'Connor, 2002; Mikalef et al., 2020). Small and medium enterprises (SMEs) often favour incremental innovations due to their limited resources and narrower product offerings (Clifton et al., 2020). Incremental improvements are easier to integrate into existing processes and pose minimal disruption to organisational structures. Organisations must assess whether emerging technologies are "competence-enhancing," supporting incremental evolution, or "competence-destroying," rendering existing systems and knowledge obsolete (Maxwell & Metz, 2021).

The technological context of the TOE framework shapes whether an organisation's readiness facilitates or impedes technology adoption (Chatzoglou & Chatzoudes, 2016; Felemban et al., 2024). Successful adoption of Industry 4.0 requires a certain level of technological readiness, influenced by the nature of the innovation. Adopting new technologies often prompts changes to organisational structures and processes (Tidd & Bessant, 2020). Technological readiness mitigates risks associated with perceived complexity and is influenced by factors such as infrastructure and employees' digital skills (Tidd & Bessant, 2020). An organisation is deemed technologically ready when it can integrate new systems in alignment with its existing standards and values. This readiness is closely tied to perceived compatibility, which refers to the alignment between new technologies and organisational values (Malik et al., 2021). A strong sense of compatibility increases the likelihood of adopting Industry 4.0 technologies and incorporating them effectively into organisational practices.

## The Organisational Context

The organisational context, as outlined by Baker (2012), includes an organisation's characteristics and resources, such as its structural connections, communication channels, size, and availability of slack resources. These descriptive characteristics significantly influence the adoption of technological innovation. Effective communication procedures can either promote or hinder innovation, while leadership behaviour plays a role in fostering an environment receptive to change. Alblooshi et al. (2021) argue that top management should cultivate a climate that values innovation, aligns with the organisation's vision, and rewards technological advancements. Furthermore, Musaigwa (2023) stresses the importance of top leadership communicating the value of technology and building a capable team to articulate and execute the company's future direction.

Organisational executives are instrumental in enhancing performance, bridging performance gaps, and pursuing new opportunities through technology implementation (Rehman et al., 2021). They are responsible for resource allocation, minimising resistance, and promoting a positive attitude toward

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innovation (Salum & Abd Rozan, 2017; Rehman et al., 2021). Support from senior management is crucial for the successful adoption of new technology, as mistrust or scepticism at the executive level can hinder implementation efforts (Rowles & Brown, 2017; Sukathong et al., 2021). To gain organisational buy-in, senior management must present a clear strategy and secure employee support (Agote et al., 2016; Joseph et al., 2021). This requires effective, consistent communication that ensures the vision for change reaches all employees and becomes embedded in organisational culture. Failures in adoption often stem from insufficient resources and a lack of managerial support (Yang et al., 2015; Stjepić et al., 2023). In contrast, strong support from senior management can significantly improve the success of technological innovations.

Senior executives play a role in defining an organisation's long-term strategy, particularly in aligning internal processes with external digital opportunities (Gummadidala et al, 2020). Businesses capable of integrating digital technologies into their strategy gain competitive advantages in their industries (Yen et al., 2002; Okorie et al., 2023). However, many organisations struggle to adapt to the rapid pace of digital transformation and the demands of Industry 4.0. Larger companies generally have greater financial and human resources, allowing them to adopt and implement new technologies more readily than smaller firms (Dasgupta et al., 1999; Rogers, 2003; Yang et al., 2024). Additionally, larger organisations benefit from economies of scale, which maximise the returns on technology investments. The relationship between company size and innovation adoption is contingent on industry uncertainty and company size.

Effective implementation of modern technologies requires employees with the necessary knowledge and skills (Tornatzky & Fleischer, 1990). Research shows that the level of employee expertise influences executives' decisions to adopt information systems (Thong, 1999). To build trust among employees and stakeholders, senior leadership must demonstrate consistent behaviour throughout the adoption process (Agote, Aramburu & Lines, 2016). van Dierendonck and Sousa (2016) emphasise providing appropriate support to meet expectations, allocating resources, and offering training to motivate employees and external partners during technology adoption and implementation.

## Environment Context

The environmental context, as described by Baker (2012), includes external factors that influence a business's operations, such as technological suppliers, industry dynamics, and regulatory environments. This context encompasses government regulations and incentives, consumer demands, competitive pressures, industry life cycles, and stakeholder influence. Trading partners and regulatory authorities may pressure businesses to adopt specific practices (Tura et al., 2019). In a volatile market, businesses closely monitor competitors and replicate successful strategies, particularly those related to technology adoption (Awa et al., 2017; Gbemisola & Adetola, 2022). Such actions help mitigate competitive

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pressures from both rivals and trading partners. However, this imitation can lead to retaliatory behaviour and a cyclical pattern of competition (Awa et al., 2016).

Zhu and Kraemer (2005) identify regulatory support as a crucial environmental factor in the TOE framework that fosters technology adoption. Regulatory systems establish trust in modern technologies, which is vital for their acceptance. Concerns about inadequate legal protections for online transactions, as well as security and privacy risks, are significant barriers to adoption for businesses and customers alike (Tura et al., 2019). Governments can facilitate Industry 4.0 adoption by enacting legislation that ensures the reliability of the Internet as a commercial platform and promotes secure online transactions. Regulatory measures addressing security and privacy concerns are essential for creating a trustworthy environment that encourages technological innovation and adoption. In some industries, technology must be certified by regulatory bodies before implementation, and regulatory support for infrastructure can enhance an organisation's ability to adopt innovations (Kandil et al. 2024).

The TOE framework provides a comprehensive lens for analysing the adoption of Industry 4.0 in accounting by considering the interplay of technological, organisational, and environmental factors. The technological context examines the capabilities, compatibility, and complexity of Industry 4.0 technologies, such as artificial intelligence, blockchain, and big data analytics, which influence their suitability and perceived benefits in accounting practices. Organisational factors, including resource availability, leadership commitment, and workforce expertise, determine a firm's readiness and ability to integrate these advanced technologies effectively. The environmental context addresses external drivers, such as regulatory requirements, competitive pressures, and technological infrastructure, which shape the external conditions under which accounting firms operate. By integrating these dimensions, the TOE framework facilitates a structured understanding of the enablers and barriers to adopting Industry 4.0 technologies, providing actionable insights to guide strategic decision-making in accounting transformation.

## Methods and Data

The study adopted a qualitative approach, utilising semi-structured in-depth interviews to gather rich and detailed data from participants, enabling the exploration of the factors influencing the adoption of Industry 4.0 technologies in accounting. The exploratory nature of the research provided a framework for understanding this phenomenon, particularly in contexts with limited prior insights (Saunders et al., 2018). Purposive sampling was employed to recruit 13 professional accountants in leadership and managerial roles, ensuring participants possessed relevant expertise and experience in organisational change and technology adoption. Semi-structured interviews allowed for probing questions to capture nuanced perspectives, and the flexibility of this approach facilitated the identification of emerging themes (Saunders et al., 2019). Thematic analysis was employed to systematically analyse the data, identifying

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patterns and themes that contribute to a deeper understanding of the technological, organisational, and environmental factors influencing the adoption of Industry 4.0 in the accounting profession.

Additionally, steps were taken to mitigate researcher bias by maintaining a reflexive journal throughout the data collection and analysis process, allowing for critical reflection on potential influences on interpretation (Berger, 2015). The reliability of the thematic analysis was reinforced through peer debriefing, where emerging themes were discussed with fellow researchers to ensure consistency and coherence in coding and categorisation (Nowell et al., 2017). By integrating these methodological strategies, the study provides a robust and credible examination of the factors influencing the adoption of Industry 4.0 technologies in accounting.

# Results and Discussion

## Technological Factors Influencing Industry 4.0 Adoption

### Compatibility with Existing Systems.

The adoption of modern technologies within organisations is influenced by the compatibility of these technologies with existing systems and processes. When modern technologies align well with an organisation's current infrastructure, the adoption process becomes smoother and more efficient. Conversely, operational bottlenecks and resistance to change may result from incompatible or poorly communicating systems, which would ultimately undermine the expected efficiency improvements from modern technologies.

*"If the new technologies align well with the organisation's existing systems and processes, adoption becomes easier… but if these systems cannot 'talk' to each other, it creates bottlenecks and reduces the efficiency gains that these technologies promise, and it can create resistance".* (P#8)

The finding underscores that aligning Industry 4.0 technologies with existing organisational processes is essential for facilitating adoption. Pourfakhimi et al. (2019) emphasise that evaluative beliefs regarding the compatibility of new technologies with existing systems are key determinants of technology acceptance. This assertion is supported by the Technology-Organization-Environment (TOE) framework, which posits that organisational readiness and the existing technological landscape significantly influence the adoption process (Mathauer & Hofmann, 2019).

Furthermore, Cunningham et al. (2022) illustrate that the strategic alignment of technology with organisational goals is essential for successful adoption, particularly in entrepreneurial ventures where operational efficiency is paramount. Moreover, the resistance to adopting new technologies often stems from perceived inefficiencies and disruptions to established workflows. Seth et al. (2019) discuss how perceived usefulness and ease of use are vital factors in technology adoption, indicating that if new

technologies are seen as complicating existing processes rather than enhancing them, resistance is likely to occur. This aligns with findings from Mathauer and Hofmann (2019), who argue that logistics service providers face challenges in technology adoption when there is a lack of integration with existing systems, leading to inefficiencies and operational delays. This suggests that similar dynamics are at play across various sectors, including accounting, reinforcing the notion that successful adoption of Industry 4.0 technology hinges on the ability of modern systems to integrate seamlessly with established ones. Henninger & Mashatan (2021) argue that interoperable systems streamline processes, reduce errors, and enhance the value derived from digital innovations.

### The Relative Advantage of Modern Technology

The adoption of new technologies in accounting firms is influenced by the perceived benefits these technologies offer, such as improved efficiency and accuracy. Automation tools are noted for their ability to streamline repetitive tasks, thereby allowing professionals, such as accountants, to focus on more strategic activities.

*"I believe that businesses are more likely to adopt these technologies if they see clear benefits, like improved efficiency or better accuracy in financial reporting…automation tools like RPA can save much time by handling repetitive tasks, which allows accountants to focus on more strategic activities like advisory." (P#2)*

The finding shows that businesses are more likely to adopt technologies when they can identify the benefits. Tiron-Tudor (2024) discusses how Robotic Process Automation (RPA) is transforming accounting and auditing services by enhancing operational efficiency and accuracy, which are critical for organisations aiming to improve their financial reporting processes. This aligns with findings from Kielanowicz & Wnuk-Pel (2023), who emphasises that automation can significantly impact management accountants by allowing them to transition from routine tasks to more strategic roles, thus enhancing their overall contribution to the organisation.

Moreover, Sanjay et al. (2023) highlight that automated systems, such as payroll management tools, can enhance accuracy and optimise processes, leading to significant time savings and improved employee satisfaction. Eziefule et al. (2022) note that the integration of AI and automation in accounting enhances operational efficiency and improves the accuracy of financial data, which is necessary for informed decision-making. Robotic Process Automation allows accountants to shift their focus from mundane tasks to advisory roles, increasing their strategic value within organisations (Oyeniyi, 2024). This transition is important as it enables accountants to contribute to higher-level decision-making processes, aligning with the view that automation tools can free up time for more strategic activities.

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As routine tasks are automated, accountants are better positioned to adopt advisory roles, contributing to strategic decision-making and driving organisational growth. This shift reflects the transformation of the accounting profession from a focus on compliance to one centred on value creation and strategic impact (Gonçalves et al., 2022). The alignment of perceived benefits, such as efficiency and accuracy, with the TOE framework highlights how these factors influence the adoption of Industry 4.0 technologies in accounting. By improving operational efficiency and supporting strategic decision-making, these technologies address both internal organisational priorities and external environmental pressures, thereby increasing their appeal and adoption likelihood.

### Digital Trust in Modern Technology

The adoption of Industry 4.0 technologies in the accounting sector hinges on the trust organisations place in the security, transparency, and reliability of these systems. This is pertinent as these technologies are increasingly integrated into financial practices that manage sensitive information.

*"the adoption of industry 4.0 technologies like blockchain, artificial intelligence, and cloud computing depends heavily on whether organisations trust the security, transparency, and reliability of these systems, especially in the accounting sector that handles sensitive financial information. For instance, blockchain can enhance trust through its immutable record-keeping, but organisations must first believe in its ability to safeguard sensitive financial data against breaches or unauthorised access". (P#10)*

The implementation of Industry 4.0 technologies in professions like accounting that manage sensitive financial data is dependent on the creation of digital trust. This trust depends on the perceived security, transparency, and reliability of these technologies. Blockchain, for example, is lauded for its immutable record-keeping capabilities, ensuring that financial transactions are securely documented and cannot be altered retroactively (Casino et al., 2019). This characteristic directly enhances trust, as it ensures both data integrity and transparency in financial reporting. However, as the statement highlights, organisations must first perceive blockchain as capable of safeguarding sensitive financial data. Trust in this technology is often shaped by its demonstrated resilience to cyber threats and its ability to meet regulatory standards. For organisations to fully use Industry 4.0 technology, they must first possess confidence in their capacity to safeguard critical financial data from breaches and unauthorised access.

## Environment Context

### Competitive Business Environment

The ability to operate efficiently, access real-time information, and adapt to market changes can determine a business's success in today's competitive environment. The participant's statement regarding the competitive nature of the current business environment and the necessity of adopting

advanced technologies to maintain market share reveals that integrating Industry 4.0 technologies has become essential for businesses to thrive.

*"The current business environment is so competitive, and implementing these technologies will keep you in the business because if you do not, then your competitors will take a bigger share of the market. Imagine what happened during lockdown where businesses who had the ability to trade online were less affected". (#1)*

Organisations that leverage these technologies can improve collaboration and reduce operational costs, thereby positioning themselves favourably against competitors who may lag in technology adoption. Elnadi and Abdallah (2023) argue that Industry 4.0 technologies enhance system agility and responsiveness, which are critical for businesses to remain competitive in a rapidly changing market. Moreover, Industry 4.0 technologies enable agile and flexible manufacturing processes that allow businesses to respond quickly to market demands and changes, which is crucial in a competitive landscape (Gródek-Szostak et al., 2023).

The ability to trade online during lockdowns, as mentioned by the participant, is a direct reflection of how businesses that embraced digital transformation were less affected by external disruptions. Shankar, et al. (2021) emphasise that without embracing these technologies, businesses risk losing market share to more technologically adept competitors. Therefore, organisations that adopt these technologies can streamline their operations and improve their market positioning, thereby mitigating the risks associated with competitive pressures.

### Legal Requirements

The participant's view regarding the influence of the legal environment on technology adoption emphasises the necessity to comply with legal requirements and reporting standards, which is increasingly shaping the technological landscape within which accountants operate.

*"The other thing we can say is the legal environment that I think comes into play. The environment that you operate in may force you to adopt certain technology... so if you want to maintain the traditional system, which means your reports will not meet current legal requirements and reporting standards. Like now accountants have to report on the impact of business activity on the environment". (P#4)*

Compliance with legal requirements and reporting standards requires the integration of advanced technologies to ensure accurate and timely reporting. Indriyani & Mappanyukki (2022) suggest that adherence to legal standards necessitates the integration of advanced technologies, which in turn enhances the reliability and transparency of financial reporting. Furthermore, Nirwana & Haliah (2018) assert that there is a direct relationship between the quality of accounting reports and legislative requirements. This relationship underlines accountants' need to adopt technologies that enable

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compliance with evolving legal standards, particularly those related to environmental impacts and sustainability reporting.

Additionally, Pinto et al. (2020) examined the impact of accounting standards on reporting procedures, specifically how the accuracy of these standards affects auditor communication and the overall quality of financial reporting. Their study found that as legal requirements become more stringent, the need for accurate and timely reporting increases, further compelling accountants to leverage technology to meet these demands. Moreover, Lombardi & Secundo (2020) show how emerging technologies are being utilised to enhance compliance with legal and regulatory frameworks. The authors argue that digital technologies facilitate better stakeholder engagement and improve the quality of corporate information management, which is essential for meeting legal obligations.

### Relevance and Up to Date

The competitive pressures and the necessity for compliance with evolving standards emphasise the need for organisations to stay aligned with technological advancements. Organisations that fail to adapt may compromise their market share, security, and legal compliance.

*"Sometimes you do not want to be left behind, so you end up following the industry leaders because if the system you are using becomes obsolete, it becomes vulnerable to cyber-attacks as your system may not be supported anymore by the service provider for security updates". (P#6)*

The participant's statement regarding adopting current technologies to avoid obsolescence and vulnerability to cyber-attacks underscores the importance of staying aligned with industry leaders in technology adoption. Competitive pressures and the risks of outdated systems necessitate keeping up with technological innovations. Cooper (2024) explains that market competition, regulatory changes, and industry standards compel businesses to adopt new technologies to remain viable. This aligns with the participant's view that failing to keep pace with technological advancements can lead to obsolescence and increased vulnerability to cyber threats. Moreover, Mohiuddin et al. (2023) argue that supportive government and organisational structures are essential for businesses to embrace new technologies effectively.

Organisations that fail to modernise their systems may miss out on operational efficiencies and expose themselves to security vulnerabilities as service providers discontinue support for legacy systems (Kandasamy, Venkat & Mani, 2023). This highlights the need for organisations to adopt proactive measures to safeguard against potential cyber threats associated with outdated systems. The competitive landscape necessitates that organisations remain vigilant and responsive to technological advancements. Karmaker et al. (2021) indicate that the COVID-19 pandemic has accelerated the need for businesses to adopt modern technologies to ensure operational continuity and security. This

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reinforces the participant's assertion that organisations must not lag behind industry leaders to avoid being left vulnerable.

## Organisational Context

### Financial Resources

The participant's assertion regarding the importance of financial resources in adopting modern technologies, such as blockchain and artificial intelligence, highlights the disparity in financial capabilities between small accounting firms and larger firms. The disparity in financial capabilities between accounting firms influences their ability to implement advanced technologies and hire skilled labour.

*"The financial resources of an organisation will help in all aspects whether it is for acquiring the modern technology, acquiring the skills and the training for the employees… because I cannot expect a small accounting firm to deploy technologies like blockchain and artificial intelligence because of the cost and resources required to research and implement these technologies as compared to big accounting firms". (P#5)*

The financial resources available to an organisation play a crucial role in shaping its technological capabilities. Bettiol et al. (2021) highlight that small and medium-sized enterprises (SMEs) with better economic and financial performance are more likely to adopt advanced technologies, emphasising the relevance of financial resources in the digital transformation process. This supports the participant's view that smaller firms may struggle to deploy sophisticated technologies due to limited financial resources.

Moreover, Bakhary (2023) identifies the shortage of financial resources as one of the most significant challenges SMEs face in implementing Industry 4.0 technologies. The study indicates that many concepts associated with Industry 4.0 require substantial investments in advanced technologies, which smaller firms often cannot afford. This reinforces the notion that financial constraints can hinder the ability of smaller accounting firms to adopt cutting-edge technologies. Additionally, Tajeddini et al. (2020) suggest that entrepreneurial firms with limited financial resources can only access inexpensive technologies that provide temporary competitive advantages. This indicates that while some technology adoption is possible, the lack of substantial financial backing restricts the potential for significant advancements.

### Management Support

Effective leadership is fundamental for resource allocation, addressing employee resistance, and fostering a culture of innovation necessary for navigating the complexities of Industry 4.0. The

participants echo a similar view regarding the critical role of top management in the successful implementation of modern technologies.

*"To successfully implement modern technologies associated with Industry 4.0, top management must take a leading role. They are responsible for allocating the necessary resources and demonstrating strong leadership to address and mitigate potential resistance from employees who might oppose or attempt to undermine the process". (P#12)*

Top management's involvement is essential for resource allocation, addressing employee resistance, and fostering a culture conducive to technological change. Hashimy et al. (2022) found that strong leadership from top management is crucial for channelling the adoption of new technologies within organisations. Their research highlights that top management plays a significant role in validating the adoption process and mitigating employee resistance. This supports the participant's view that leadership is necessary to address potential opposition during the implementation of new technologies.

Similarly, Ghani et al. (2022) assert that top management support positively influences the adoption of technological advancements in organisations. Their findings indicate that effective leadership is associated with successful technology adoption, reinforcing the idea that management must take an active role in guiding the transition to modern technologies. This is particularly relevant in the context of Industry 4.0, where the pace of technological change can be daunting for employees. Furthermore, Hsu et al. (2019) illustrate that openness to technology adoption and strong top-management support can drive service innovation. This suggests that top management needs to allocate resources but also foster an environment that encourages innovation and reduces resistance among employees. This is essential for ensuring the workforce is aligned with the organisation's technological goals. Therefore, management's commitment to technological advancement is vital for organisations to remain competitive and responsive to market demands.

### Organisation Structure

Organisations can enhance their innovative capabilities and reduce resistance to change by creating an inclusive environment where employees feel valued and are encouraged to contribute ideas. This is substantiated by the participant's assertion regarding the importance of cross-functional collaboration and employee empowerment in fostering innovation.

*"An organisation should encourage cross-functional collaboration and empower employees at all levels to contribute ideas, as this fosters innovation, reduces resistance, and ensures employees feel valued and included in the decision-making process." (P#3)*

Encouraging collaboration among employees at all levels enhances innovation but also reduces resistance to change and ensures that employees feel valued and included in the decision-making

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process. Caccamo (2020) suggests that creating environments that encourage collaboration across different functions can lead to more innovative outcomes, aligning with the participant's view that collaboration is essential for fostering innovation. Moreover, Juracka et al. (2024) highlight the significance of open innovation, which encourages collaboration with external partners and internal stakeholders. This approach contrasts with traditional models and emphasises the importance of involving diverse perspectives in the innovation process. By empowering employees to contribute ideas, organisations can tap into a broader range of insights and foster a culture of innovation.

Additionally, Trivellato et al. (2021) indicate that organisations that promote collaboration and empower employees are better positioned to adapt to changes and sustain innovation over time. This reinforces the participant's assertion that employee involvement is critical for successful innovation. Verhoest et al. (2024) revealed that organisations that actively promote collaboration across different sectors can overcome barriers to innovation and enhance their overall performance. A study by Hsieh (2024) emphasises the importance of fostering a culture of collaboration and innovation within organisations. Organisations can enhance commitment and drive successful outcomes by treating employees as integral parts of the innovation process.

## The Impact of Industry 4.0 on Accounting Practices

### Cloud Storage and Information Access

The participant's views on the transformative impact of Industry 4.0 technologies, particularly cloud computing, on data storage, sharing, and access reveal how modern technologies are influencing the work of accountants. Cloud computing has revolutionised how businesses manage their data, enabling remote access and collaborative work, which aligns with the participant's assertion that it allows accountants and other professionals to work remotely and collaboratively on shared documents.

*"With data storage, I think cloud computing is changing how we store, share and access information. Currently, most businesses are storing their information on the cloud, which makes it possible for them to retrieve information or have access to their data at any time from anywhere and easily expand the storage. This is because you no longer have to be restricted by the information being locked up somewhere, but it is now stored in the cloud where you can access it at any place and at any time… this enables accountants to work remotely but also more than one person can now work on the same document at the same time as opposed to the paper".(P#11)*

Cloud computing facilitates the storage and retrieval of data from virtually anywhere, marking a significant shift from traditional data storage methods. According to Huang et al. (2020), cloud technology provides robust support for storing massive industrial data and enhances the efficiency of complex calculations across various applications by offloading data to cloud data centres. This capability

allows multiple users to access and work on the same documents simultaneously, a feature that is particularly beneficial for collaborative environments, as highlighted by Hammami et al. (2020), who note that cloud computing enables businesses to store data and access applications remotely, thus fostering collaboration and agility.

Moreover, the scalability of cloud services is a critical advantage, as it allows businesses to expand their storage capabilities without the constraints of physical infrastructure. This is echoed by Yang et al. (2020), who describe cloud storage as an attractive service that integrates numerous distributed storage devices and provides users with convenient data storage and access services. The flexibility and accessibility of cloud computing are further emphasised by Amani et al. (2019), who discuss how platforms like Google Earth Engine and Amazon Web Services facilitate the manipulation and analysis of large datasets, thereby enhancing operational efficiency. The participant's mention of remote work is particularly relevant in the ongoing digital transformation accelerated by the COVID-19 pandemic. As noted by Crîșmariu and Șomîtcă (2022), the adoption of cloud computing in various sectors, including public services, has been crucial for enabling remote work and ensuring continuity of operations during disruptions. This transition to cloud-based systems improved accessibility and led to a paradigm shift in how organisations approach data management and collaboration.

### Remote Working

Flexible working can also become possible due to technology. Accountants do not have to be seen as people who only work from the office as per traditional methods. They can now work remotely as all accounting and financial systems can be online. Participant P*#1* points out that Industry 4.0 is transforming the office setting by facilitating remote working.

*"Digital technologies have changed the work environment of accountants... like most of the time now, I work from home, which has saved me the stress of sitting in traffic and petrol imagine during lockdown, everybody was working from home thanks to technology, and I do not think we will go back to the traditional office setting but possibly a hybrid system of working". (P#1)*

The advancement in technology has brought flexibility in working schedules for accountants. Cloud storage enables accountants access to information from anywhere at any time. This allows accountants to work from home at different times. With the advent of remote working, accountants are no longer constrained to settling in close proximity to their place of employment. Remote working, therefore, allows for greater geographic mobility and the possibility of continued employment with a given firm regardless of the employee's physical location. When accountants work remotely, they can save on costs associated with work clothing, given that workers have the freedom to choose how they dress for work. Accounting firms can also save money on rent by letting accountants work remotely. But this benefit also extends to accountants, who will save on travel costs. Kicheva (2021) suggests that businesses

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can save money on rent, utilities, and other overhead expenses. Due to less time spent commuting, workers may be able to work longer hours every day.

### Evolving Accounting Skills and Roles

The participant's observations regarding the evolving roles within the accounting profession due to Industry 4.0 technologies highlight the impact of digital technologies on accounting practices and the skill sets required for accounting professionals. The shift from traditional roles to more analytical and technology-driven positions is a significant theme in the current discourse on accounting.

*"…from number crunching to system analyst, which was previously left for IT specialist, but at the same time, we are also seeing people who do not have any background in accounting are now performing accounting duties because of these new technologies… you have seen engineers being employed in accounting firms. Industry 4.0 has made us realise that some skills will be replaceable in the future, and there are things that would not require human intervention". (P#9)*

The integration of digital technologies into accounting has led to a transformation in the roles and responsibilities of accountants. Andreassen (2020) highlights that digital technology is reshaping the identities and roles of management accountants, leading to a competitive environment where various professions, including those without traditional accounting backgrounds, are increasingly involved in accounting tasks. This aligns with the participant's observation that individuals without formal accounting training, such as engineers, are now performing accounting duties, reflecting a broader trend of role diversification within the profession.

Moreover, the emergence of technologies such as blockchain and cloud computing has further influenced the accounting landscape. Abdennadher et al. (2021) discuss how blockchain technology is reshaping the accounting and auditing profession, emphasising the need for accountants to adapt to new technological frameworks. Similarly, Prasetianingrum & Sonjaya (2024) notes that the evolution of digital accounting systems necessitates a re-evaluation of the skills required in the accounting profession, indicating that traditional accounting roles are being supplemented or replaced by technology-driven functions. This is echoed by Kroon et al. (2021), who identify the essential skills that modern accountants must possess in light of emerging technologies, reinforcing the idea that the profession is evolving to include roles previously in the domain of IT specialists.

The participant's view that certain skills may become replaceable due to technological advancements is supported by the findings of Lombardi and Secundo (2021), who argue that digital transformation is disrupting traditional accounting practices and necessitating new competencies. The need for accountants to embrace technology and develop analytical skills is further emphasised by Zhang et al. (2020), who explored how artificial intelligence and blockchain are revolutionising the accounting

profession, leading to a demand for a new skill set that includes data analysis and technological proficiency.

## Conclusion

The study underscores the pivotal role of Industry 4.0 technologies in transforming the accounting profession. Using the Technology-Organisation-Environment (TOE) framework, the findings reveal that successful adoption hinges on technological compatibility, organisational readiness, and environmental pressures, such as competition and regulatory requirements. The research indicates that technologies like blockchain, robotic process automation, artificial intelligence, and cloud computing improve operational efficiency and transform accounting practices by shifting the focus from routine duties to strategic and advisory roles. The research highlights that adoption is facilitated by alignment with existing systems, demonstrable efficiency gains, and establishing digital trust. However, resource constraints, lack of integration, and resistance to change remain significant challenges, particularly for smaller firms with limited financial capacity. Organisational leadership and support play a crucial role in overcoming these barriers, ensuring effective resource allocation, and fostering a culture of innovation.

- The study affirms the relevance of the TOE framework in understanding technology adoption within the accounting profession, especially by integrating digital trust and the evolving strategic role of accountants into the analysis.
- Organisations must prioritise leadership-driven strategies that promote digital readiness, workforce development, and alignment between technological solutions and operational goals to realise the benefits of Industry 4.0.

The accounting profession can increase its strategic value and ensure its relevance in a digitalised business environment by leveraging the transformative potential of Industry 4.0 technologies.

## References

Abdennadher, S., Grassa, R., Abdulla, H., & Alfalasi, A. (2022). The effects of blockchain technology on the accounting and assurance profession in the UAE: an exploratory study. *Journal of Financial Reporting and Accounting*, *20*(1), 53-71.

Adnan, M. (2024). Factors influencing the integration of cloud computing in modern accounting practices in the malaysian accounting sector: a conceptual study. *Accounting and Finance Research,* 13(2), 63. https://doi.org/10.5430/afr.v13n2p63

Agote, L., Aramburu, N., & Lines, R. (2016). Authentic leadership perception, trust in the leader, and followers' emotions in organizational change processes. *The Journal of Applied Behavioral Science*, *52*(1), 35-63.

Ahmed, I. (2020). Technology organization environment framework in cloud computing. *TELKOMNIKA (Telecommunication Computing Electronics and Control)*, *18*(2), 716-725.

Al Hadwer, A., Tavana, M., Gillis, D., & Rezania, D. (2021). A systematic review of organizational factors impacting cloud-based technology adoption using technology-organization-environment framework. *Internet of Things*, *15*, 100407.

Alblooshi, M., Shamsuzzaman, M., & Haridy, S. (2021). The relationship between leadership styles and organisational innovation: A systematic literature review and narrative synthesis. *European Journal of Innovation Management*, *24*(2), 338-370.

Al-Htaybat, K. and Alberti-Alhtaybat, L. (2017). Big data and corporate reporting: impacts and paradoxes. *Accounting Auditing & Accountability Journal*, 30(4), 850-873. https://doi.org/10.1108/aaaj-07-2015-2139

Ali, S. and Xie, Y. (2021). The impact of industry 4.0 on organizational performance: the case of pakistan's retail industry. *European Journal of Management Studies,* 26(2/3), 63-86. https://doi.org/10.1108/ejms-01-2021-0009

Amani, M., Brisco, B., Afshar, M., Mirmazloumi, S.M., Mahdavi, S., Mirzadeh, S.M.J., Huang, W., & Granger, J. (2019). A generalized supervised classification scheme to produce provincial wetland inventory maps: An application of Google Earth Engine for big geo data processing. *Big Earth Data*, *3*(4), 378-394.

Anandarajan, A., Srinivasan, C.A., & Anandarajan, M. 2004. Historical overview of accounting information systems. In *Business intelligence techniques*. Berlin, Heidelberg: Springer, 1-19.

Andreassen, R. I. (2020). Digital technology and changing roles: a management accountant's dream or nightmare?. *Journal of management control*, *31*(3), 209-238.

Appelbaum, D., Cohen, E., Kinory, E., & Stein Smith, S. (2022). Impediments to blockchain adoption. *Journal of Emerging Technologies in Accounting*, *19*(2), 199-210.

Awa, H. O., Baridam, D. M., & Nwibere, B. M. (2015). Demographic determinants of electronic commerce (EC) adoption by SMEs: A twist by location factors. *Journal of Enterprise Information Management*, *28*(3), 326-345.

Awa, H. O., Ojiabo, O. U., & Orokor, L. E. (2017). Integrated technology-organization-environment (TOE) taxonomies for technology adoption. *Journal of Enterprise Information Management*, *30*(6), 893-921.

Awa, H. O., Ukoha, O., & Emecheta, B. C. (2016). Using TOE theoretical framework to study the adoption of ERP solution. *Cogent Business & Management*, *3*(1), 1196571.

Awa, H. O., Ukoha, O., & Igwe, S. R. (2017). Revisiting technology-organization-environment (TOE) theory for enriched applicability. *The Bottom Line*, *30*(01), 2-22.

Bagherian, A., Srivastav, A. L., & Mukherjee, S. (2024). Exploring barriers and strategic approaches in smart factory adoption: A real-world case study in a German manufacturing company. *The International Journal of Advanced Manufacturing Technology*, 134, 5191–5224. https://doi.org/10.1007/s00170-024-14340-x

Baker, J. (2012). The technology–organization–environment framework. *Information Systems Theory: Explaining and Predicting Our Digital Society, Vol. 1*, 231-245.

Bakhary, N. A. (2023, August). Semi-Structured Interview of Industry 4.0 for SMEs in the Malaysian Construction Industry. In *European Conference on Research Methodology for Business and Management Studies* (Vol. 22, No. 1, pp. 9-17).

Berger, R. (2015). *Now I see it, now I don't: Researcher's position and reflexivity in qualitative research.* Qualitative Research, **15**(2), 219-234. https://doi.org/10.1177/1468794112468475

Bettiol, M., Capestro, M., Di Maria, E., & Micelli, S. (2022). Disentangling the link between ICT and Industry 4.0: impacts on knowledge-related performance. *International journal of productivity and performance management*, *71*(4), 1076-1098.

Bose, S., Dey, S. K., & Bhattacharjee, S. (2023). Big data, data analytics and artificial intelligence in accounting: An overview. *Handbook of big data research methods*, 32-51.

Caccamo, M. (2020). Leveraging innovation spaces to foster collaborative innovation. *Creativity and Innovation Management*, *29*(1), 178-191.

Cai, C.W. (2021). Triple-entry accounting with blockchain: How far have we come? *Accounting & Finance*, *61*(1): 71–93.

Cai, C.W. (2021). Triple-entry accounting with blockchain: How far have we come? *Accounting & Finance*, *61*(1): 71-93.

Casino, F., Dasaklis, T. K., & Patsakis, C. (2019). A systematic literature review of blockchain-based applications: Current status, classification and open issues. *Telematics and informatics*, *36*, 55-81.

Chatzoglou, P., & Chatzoudes, D. (2016). Factors affecting e-business adoption in SMEs: an empirical research. *Journal of Enterprise Information Management*, *29*(3), 327-358.

Clifton, N., Huggins, R., Pickernell, D., Prokop, D., Smith, D., & Thompson, P. (2020). Networking and strategic planning to enhance small and medium-sized enterprises growth in a less competitive economy. *Strategic Change*, *29*(6), 699-711.

Cooper, R. G. (2024). The AI transformation of product innovation. *Industrial Marketing Management*, *119*, 62-74.

Cunningham, J., Damij, N., & Modic, D. (2022). An exploratory study of high-performance computing technology adoption over the stages of entrepreneurship. *International Journal of Entrepreneurial Venturing,* 14(4/5), 497. https://doi.org/10.1504/ijev.2022.127444

Damayanti, C. (2019). Accounting and its challenges in the new era. https://doi.org/10.2991/aicobpa-18.2019.19

Dasgupta, S., Agarwal, D., Ioannidis, A., & Gopalakrishnan, S. (1999). Determinants of information technology adoption: An extension of existing models to firms in a developing country. *Journal of Global Information Management (JGIM)*, *7*(3), 30-40.

Devine, P.W., Srinivasan, C.A., & Zaman, M.S. (2004). Importance of Data in Decision-Making. In: Anandarajan, M., Anandarajan, A., Srinivasan, C.A. eds. *Business Intelligence Techniques*. Berlin, Heidelberg: Springer, 21-39.

Edwards, J. R., & Boyns, T. (2022). Published accounts, stewardship, and decision making: A case study 1863–1940. *Abacus*, *58*(2), 300-333.

Elnadi, M., & Abdallah, Y. O. (2024). Industry 4.0: critical investigations and synthesis of key findings. *Management Review Quarterly*, *74*(2), 711-744.

Eziefule, A. O., Adelakun, B. O., Okoye, I. N., & Attieku, J. S. (2022). The Role of AI in Automating Routine Accounting Tasks: Efficiency Gains and Workforce Implications. *European Journal of Accounting, Auditing and Finance Research*, *10*(12), 109-134.

Faccia, A., & Mosteanu, N. R. (2019). Accounting and blockchain technology: from double-entry to triple-entry. *The Business & Management Review*, *10*(2), 108-116.

Felemban, H., Sohail, M., & Ruikar, K. (2024). Exploring the Readiness of Organisations to Adopt Artificial Intelligence. *Buildings*, *14*(8), 2460. https://doi.org/10.3390/buildings14082460

Franke, F. and Hiebl, M. (2022). Big data and decision quality: the role of management accountants' data analytics skills. International Journal of Accounting and Information Management, 31(1), 93-127. https://doi.org/10.1108/ijaim-12-2021-0246

Gbemisola, O., & Adetola, A. A. (2022). Exploring the Benefits of Technology Adoption on Business Performance among Unregistered SMEs: Insights from Nigeria. *Asian Journal of Economics, Business and Accounting*, *22*(21), 182-188.

Ghani, E. K., Ariffin, N., & Sukmadilaga, C. (2022). Factors influencing artificial intelligence adoption in publicly listed manufacturing companies: a technology, organisation, and environment approach. *International Journal of Applied Economics, Finance and Accounting*, *14*(2), 108-117.

Godina, R., Ribeiro, I., Matos, F., Ferreira, B., Carvalho, H., & Peças, P. (2020). Impact assessment of additive manufacturing on sustainable business models in industry 4.0 context. Sustainability, 12(17), 7066. https://doi.org/10.3390/su12177066

Gonçalves, M. J. A., da Silva, A. C. F., & Ferreira, C. G. (2022). The Future of Accounting: How Will Digital Transformation Impact the Sector? *Informatics*, *9*(1), 19. https://doi.org/10.3390/informatics9010019

Gonçalves, M. J. A., da Silva, A. C. F., & Ferreira, C. G. (2022). The Future of Accounting: How Will Digital Transformation Impact the Sector? *Informatics*, *9*(1), 19. https://doi.org/10.3390/informatics9010019

Gotthardt, M., Koivulaakso, D., Paksoy, O., Saramo, C., Martikainen, M., & Lehner, O. (2020). Current state and challenges in the implementation of smart robotic process automation in accounting and auditing. *ACRN Journal of Finance and Risk Perspectives*, *9*(1), 90-102.

Gregurec, I., Tomičić Furjan, M., & Tomičić-Pupek, K. (2021). The impact of COVID-19 on sustainable business models in SMEs. *Sustainability*, *13*(3), 1098.

Gródek-Szostak, Z., Siguencia, L. O., Niemczyk, A., & Szeląg-Sikora, A. (2023). From Industry 4.0 Paradigm Towards Industry 5.0. In *ENVIRONMENT. TECHNOLOGIES. RESOURCES. Proceedings of the International Scientific and Practical Conference,* 2, 46-49.

Gummadidala, P. R., Karippur, N. K., & Koilakuntla, M. (2020). Analysis of Factors Influencing the Adoption of Artificial Intelligence for Crime Management. In *Re-imagining Diffusion and Adoption of Information Technology and Systems: A Continuing Conversation: IFIP WG 8.6 International Conference on Transfer and Diffusion of IT, TDIT 2020, Tiruchirappalli, India, December 18–19, 2020, Proceedings, Part I* (3-9). Springer International Publishing.

Hacioglu, U. (2020). Digital business strategies in blockchain ecosystems. *Springer International Publishing, 10*: 978-3.

Hammami, H., Yahia, S. B., & Obaidat, M. S. (2021). A lightweight anonymous authentication scheme for secure cloud computing services. *The Journal of Supercomputing*, *77*(2), 1693-1713.

Handoyo, S. (2024). Evolving paradigms in accounting education: A bibliometric study on the impact of information technology. *The International Journal of Management Education*, *22*(3), 100998.

Hashimy, L., Jain, G., & Grifell-Tatjé, E. (2022). Determinants of blockchain adoption as decentralized business model by spanish firms – an innovation theory perspective. *Industrial Management & Data Systems*, 123(1), 204-228. https://doi.org/10.1108/imds-01-2022-0030

Henninger, A., & Mashatan, A. (2021). Distributed interoperable records: The key to better supply chain management. *Computers*, *10*(7), 89. https://doi.org/10.3390/computers10070089

Hsieh, C. L., Hung, C. H., & Shih, Y. S. (2024). Construct Sustainable Innovation Service Strategies Decision-making Model from ESG and Financial Perspectives. *Journal of Accounting, Finance & Management Strategy*, *19*(2), 171-203.

Hsu, H. Y., Liu, F. H., Tsou, H. T., & Chen, L. J. (2019). Openness of technology adoption, top management support and service innovation: a social innovation perspective. *Journal of Business & Industrial Marketing*, *34*(3), 575-590.

Hughes, L., Dwivedi, Y., Rana, N., Williams, M., & Raghavan, V. (2020). Perspectives on the future of manufacturing within the industry 4.0 era. Production Planning & Control, 33(2-3), 138-158. https://doi.org/10.1080/09537287.2020.1810762

Indriyani, D., & Mappanyukki, R. (2022). The effect of government accounting standards, utilization of information technology, and accounting internal control on the quality of financial reports with organizational commitments as moderating variables. *Fair Value: Jurnal Ilmiah Akuntansi dan Keuangan*, *5*(4), 1994-2006.

Joseph, A., Gupta, S., Wang, Y., & Schoefer, K. (2021). Corporate rebranding: An internal perspective. *Journal of Business Research*, *130*, 709-723.

Juracka, D., Nagy, M., Valaskova, K., & Nica, E. (2024). A Meta-Analysis of Innovation Management in Scientific Research: Unveiling the Frontier. *Systems*, *12*(4), 130.

Kablan, A. (2020). Dark Factories from an Industry 4.0 Perspective: Its Effects on Cost Accounting and Managerial Accounting. In: Hacioglu, U. eds. *Digital Business Strategies in Blockchain Ecosystems. Contributions to Management Science*. Berlin, Heidelberg: Springer, 503-518.

Kandasamy, J., Venkat, V., & Mani, R. S. (2023). Barriers to the adoption of digital technologies in a functional circular economy network. *Operations Management Research*, *16*(3), 1541-1561.

Kandil, S., Marzbani, F., & Shamayleh, A. (2024). Beyond Blockchain: Enhancing Data Sharing in Supply Chains through Horizontal Federated Learning in IoT-Enabled VMI Systems. In *2024 Advances in Science and Engineering Technology International Conferences (ASET)* (pp. 01-07). IEEE.

Karmaker, C. L., Ahmed, T., Ahmed, S., Ali, S. M., Moktadir, M. A., & Kabir, G. (2021). Improving supply chain sustainability in the context of COVID-19 pandemic in an emerging economy: Exploring drivers using an integrated model. *Sustainable production and consumption*, *26*, 411-427.

Kicheva, T. (2021). Opportunities and challenges of remote work. *Izvestiya. Journal of Varna University of Economics*, *65*(2), 145-160.

Kielanowicz, Ż., & Wnuk-Pel, T. (2023). Financial Processes Automations' Impact on the Work of Management Accountants. *European Research Studies Journal*, *26*(3), 297-313.

Kroon, N., Alves, M. d. C., & Martins, I. (2021). The Impacts of Emerging Technologies on Accountants' Role and Skills: Connecting to Open Innovation—A Systematic Literature Review. *Journal of Open Innovation: Technology, Market, and Complexity*, *7*(3), 163. https://doi.org/10.3390/joitmc7030163

Kurt, R. (2019). Industry 4.0 in terms of industrial relations and its impacts on labour life. *Procedia computer science*, *158*, 590-601.

Li, W., Wang, X., Li, L., & Zhong, X. (2023). The current development status and problems analysis of intelligent manufacturing in China. *Manufacturing and Service Operations Management,* 4(5), 51-57. https://doi.org/10.23977/msom.2023.040507

Li, Z. (2023). Chinese manufacturing industry in the context of industry 4.0. Advances in Economics Management and Political Sciences, 25(1), 7-12. https://doi.org/10.54254/2754-1169/25/20230467

Lombardi, R., & Secundo, G. (2021). The digital transformation of corporate reporting–a systematic literature review and avenues for future research. *Meditari Accountancy Research*, *29*(5), 1179-1208.

Lombardi, R., & Secundo, G. (2021). The digital transformation of corporate reporting–a systematic literature review and avenues for future research. *Meditari Accountancy Research*, *29*(5), 1179-1208.

Lv, T., Zhang, J., & Chen, Y. (2018). Research of erp platform based on cloud computing. Iop Conference Series Materials Science and Engineering, 394, 042004. https://doi.org/10.1088/1757-899x/394/4/042004

Malik, S., Chadhar, M., Vatanasakdakul, S., & Chetty, M. (2021). Factors affecting the organizational adoption of blockchain technology: Extending the technology–organization–environment (TOE) framework in the Australian context. *Sustainability*, *13*(16), 9404.

Malik, S., Chadhar, M., Vatanasakdakul, S., & Chetty, M. (2021). Factors affecting the organizational adoption of blockchain technology: Extending the technology–organization–environment (TOE) framework in the Australian context. *Sustainability*, *13*(16), 9404.

Mancini, D., Vaassen, E. H., & Dameri, R. P. (2013). Trends in accounting information systems. In *Accounting Information Systems for Decision Making* (pp. 1-11). Berlin, Heidelberg: Springer Berlin Heidelberg.

Marešová, P., Soukal, I., Svobodová, L., Hedvičáková, M., Javanmardi, E., Selamat, A., & Krejcar, O. (2018). Consequences of industry 4.0 in business and economics. Economies, 6(3), 46. https://doi.org/10.3390/economies6030046

Mason, R.O. 2004. The legacy of LEO: Lessons learned from an English tea and cake company's pioneering efforts in information systems. *Journal of the Association for Information Systems*, *5*(5): 183-219.

Maxwell, J., & Metz, K. (2021). How Technology Life Cycles Increase the Financial Position of the Firm. *American Journal of Management*, *21*(3), 1-8.

McBride, K. and Philippou, C. (2021). “big results require big ambitions”: big data, data analytics and accounting in masters courses. Accounting Research Journal, 35(1), 71-100. https://doi.org/10.1108/arj-04-2020-0077

McDermott, C. M., & O'connor, G. C. (2002). Managing radical innovation: an overview of emergent strategy issues. *Journal of Product Innovation Management: an international publication of the product development & management association*, *19*(6), 424-438.

Mikalef, P., Boura, M., Lekakos, G., & Krogstie, J. (2020). The role of information governance in big data analytics driven innovation. *Information & Management*, *57*(7), 103361.

Mohiuddin, M., Reza, M. N. H., Jayashree, S., Al-Azad, M. S., & Ed-Dafali, S. (2023). The Role of Governments in Driving Industry 4.0 Adoption in Emerging Countries: Mediating Effect of Organizational Structure. *Journal of Global Information Management (JGIM)*, *31*(1), 1-31.

Musaigwa, M. (2023). The Role of Leadership in Managing Change. *International Review of Management and Marketing*, *13*(6), 1-9.

Nguyen, T. H., Le, X. C., & Vu, T. H. L. (2022). An extended technology-organization-environment (TOE) framework for online retailing utilization in digital transformation: Empirical evidence from Vietnam. *Journal of Open Innovation: Technology, Market, and Complexity*, *8*(4), 200.

Nirwana, N., & Haliah, H. (2018). Determinant factor of the quality of financial statements and performance of the government by adding contextual factors: Personal factor, system/administrative factor. *Asian Journal of Accounting Research*, *3*(1), 28-40.

Nowell, L. S., Norris, J. M., White, D. E., & Moules, N. J. (2017). *Thematic analysis: Striving to meet the trustworthiness criteria.* International Journal of Qualitative Methods, **16**(1), 1-13. https://doi.org/10.1177/1609406917733847

Nwachukwu, C.E., Usman, T.O., Akhor, S.O., & Oladipupo, A.O. (2021). Auditing in the New Age of Industry 4.0: The Need for More Research. *International Journal of Business Strategy and Automation (IJBSA)*, *2*(1):17-28.

Okorie, O., Russell, J., Cherrington, R., Fisher, O., & Charnley, F. (2023). Digital transformation and the circular economy: Creating a competitive advantage from the transition towards Net Zero Manufacturing. *Resources, Conservation and Recycling*, *189*, 106756.

Oyeniyi, L. (2024). Robotic process automation in routine accounting tasks: a review and efficiency analysis. World Journal of Advanced Research and Reviews, 22(1), 695-711. https://doi.org/10.30574/wjarr.2024.22.1.1156

Oyewole, A. T., Adeoye, O. B., Addy, W. A., Okoye, C. C., Ofodile, O. C., & Ugochukwu, C. E. (2024). Automating financial reporting with natural language processing: A review and case analysis. *World Journal of Advanced Research and Reviews*, *21*(3), 575-589.

Patil, S., & Shankar, H. (2023). Transforming healthcare: harnessing the power of AI in the modern era. *International Journal of Multidisciplinary Sciences and Arts*, *2*(1), 60-70.

Pedota, M., Grilli, L., & Piscitello, L. (2023). Technology adoption and upskilling in the wake of Industry 4.0. *Technological Forecasting and Social Change*, *187*, 122085.

Peters, E., Kliestik, T., Musa, H., & Durana, P. (2020). Product decision-making information systems, real-time big data analytics, and deep learning-enabled smart process planning in sustainable industry 4.0. *Journal of Self-Governance and Management Economics*, *8*(3), 16-22.

Pinto, I., Morais, A. I., & Quick, R. (2020). The impact of the precision of accounting standards on the expanded auditor's report in the European Union. *Journal of International Accounting, Auditing and Taxation*, *40*, 100333.

Pourfakhimi, S., Duncan, T., & Coetzee, W. (2019). A critique of the progress of etourism technology acceptance research: time for a hike?. Journal of Hospitality and Tourism Technology, ahead-of-print(ahead-of-print). https://doi.org/10.1108/jhtt-08-2018-0077

Rehman, N., Mahmood, A., Ibtasam, M., Murtaza, S. A., Iqbal, N., & Molnár, E. (2021). The psychology of resistance to change: the antidotal effect of organizational justice, support and leader-member exchange. *Frontiers in psychology*, *12*, 678952. https://doi.org/10.3389/fpsyg.2021.678952

Rogers, E.M., 2003. *Diffusion of innovations.* 5th ed. New York: Free Press

Rowles, D., & Brown, T. (2017). *Building digital culture: A practical guide to successful digital transformation*. Kogan Page Publishers.

Salum, K. H., & Abd Rozan, M. Z. (2017). Conceptual model for cloud ERP adoption for SMEs. *Journal of Theoretical and Applied Information Technology*, *95*(4), 743-756.

Sarker, I. (2021). Deep learning: a comprehensive overview on techniques, taxonomy, applications and research directions. Sn Computer Science, 2(6). https://doi.org/10.1007/s42979-021-00815-1

Saunders, B., Sim, J., Kingstone, T., Baker, S., Waterfield, J., Bartlam, B., Burroughs, H. & Jinks, C. (2018). Saturation in qualitative research: exploring its conceptualization and operationalization. *Quality & quantity*, *52*, 1893-1907.

Saunders, M. N. K., Lewis, P., & Thornhill, A. (2019). *Research methods for business students*. 7th ed. Harlow, Essex, England: Pearson Education Limited.

Saurabh, K., Rani, N., & Upadhyay, P. (2022). Towards blockchain led decentralized autonomous organization (DAO) business model innovations. *Benchmarking: An International Journal*, *30*(2), 475-502.

Saurabh, K., Upadhyay, P., & Rani, N. (2023). A study on blockchain-based marketplace governance platform adoption: a multi-industry perspective. *Digital Policy, Regulation and Governance*, *25*(6), 653-692.

Schaltegger, S., & Burritt, R. (2017). *Contemporary Environmental Accounting: Issues, Concepts and Practice*. Routledge.

Schmitz, J., & Leoni, G. (2019). Accounting and auditing at the time of blockchain technology: a research agenda. *Australian Accounting Review*, *29*(2), 331-342.

Seth, A., Coffie, A., Amoako, R., & Stephen, S. (2019). Hospital administration management technology adoption; a theoretical test of technology acceptance model and theory of planned behavior on hamt adoption. American Journal of Public Health Research, 7(1), 21-26. https://doi.org/10.12691/ajphr-7-1-4

Shankar, V., Kalyanam, K., Setia, P., Golmohammadi, A., Tirunillai, S., Douglass, T., Hennessey, J., Bull, J.S., & Waddoups, R. (2021). How technology is changing retail. *Journal of Retailing*, *97*(1), pp.13-27.

Sinha, D., & Roy, R. (2020). Reviewing cyber-physical system as a part of smart factory in industry 4.0. *IEEE Engineering Management Review*, *48*(2), 103-117.

Sousa, M., & Van Dierendonck, D. (2016). Introducing a short measure of shared servant leadership impacting team performance through team behavioral integration. *Frontiers in psychology*, *6*, 2002. https://doi.org/10.3389/fpsyg.2015.02002

Stjepić, A.-M., Pejić Bach, M., & Bosilj Vukšić, V. (2021). Exploring Risks in the Adoption of Business Intelligence in SMEs Using the TOE Framework. *Journal of Risk and Financial Management*, *14*(2), 58. https://doi.org/10.3390/jrfm14020058

Sufian, N. I. M., Kasim, E. S., Zin, N. M., & Surtikanti, S. (2023). Exploring the diffusion of big data analytics within accounting education. *Asia-Pacific Management Accounting Journal,* 18(3). https://doi.org/10.24191/apmaj.v18i3-07

Sukathong, S., Suksawang, P., & Naenna, T. (2021). Analyzing the importance of critical success factors for the adoption of advanced manufacturing technologies. *International Journal of Engineering Business Management*, *13*, 18479790211055057.

Tajeddini, K., Martin, E., & Ali, A. (2020). Enhancing hospitality business performance: The role of entrepreneurial orientation and networking ties in a dynamic environment. *International Journal of Hospitality Management*, *90*, 102605.

Thong, J. Y. (1999). An integrated model of information systems adoption in small businesses. *Journal of management information systems*, *15*(4), 187-214.

Tidd, J., & Bessant, J. R. (2020). *Managing innovation: integrating technological, market and organizational change*. John Wiley & Sons.

Tiron-Tudor, A. (2024). Perspectives on how robotic process automation is transforming accounting and auditing services. *Accounting Perspectives*, 23(1), 7-38. https://doi.org/10.1111/1911-3838.12351

Tornatzky, L. G., & Fleischer, M. (1990). *The processes of technological innovation*. Lexington,MA: Lexington Books.

Tornatzky, L. G., Fleischer, M., & Chakrabarti, A. K. (1990). *The processes of technological innovation*. Lexington Books.

Trivellato, B., Martini, M., & Cavenago, D. (2021). How do organizational capabilities sustain continuous innovation in a public setting?. *The American Review of Public Administration*, *51*(1), 57-71.

Tsiligiris, V., & Bowyer, D. (2021). Exploring the impact of 4IR on skills and personal qualities for future accountants: a proposed conceptual framework for university accounting education. *Accounting Education*, *30*(6), 621-649.

Tura, N., Keränen, J., & Patala, S. (2019). The darker side of sustainability: Tensions from sustainable business practices in business networks. *Industrial Marketing Management*, *77*, 221-231.

Turner, L., Weickgenannt, A. B., & Copeland, M. K. (2020). *Accounting information systems: controls and processes*. John Wiley & Sons.

Valdebenito, J., & Quelopana, A. (2019). Conceptual model for software as a service (SaaS) enterprise resource planning (ERP) systems adoption in small and medium sized enterprises (SMEs) using the technology-organization-environment (TOE) framework. In *Information Technology and Systems: Proceedings of ICITS 2019* (143-152). Springer International Publishing.

van Dierendonck, D., & Sousa, M. (2016). Finding meaning in highly uncertain situations: Servant leadership during change. In *Leadership lessons from compelling contexts* (pp. 403-424). Emerald Group Publishing Limited.

Verhoest, K., Callens, C., Klijn, E. H., Brogaard, L., García-Rayado, J., & Nõmmik, S. (2024). Designing cross-sector collaboration to foster technological innovation: Empirical insights from ehealth partnerships in five countries. *Public Administration Review*, *84*(6), 1200-1217.

Wang, J., Zhang, L., Duan, L., & Gao, R. (2015). A new paradigm of cloud-based predictive maintenance for intelligent manufacturing. Journal of Intelligent Manufacturing, 28(5), 1125-1137. https://doi.org/10.1007/s10845-015-1066-0

Wang, X. (2023). Research on innovative models of accounting professional teaching in the era of big data. *Advances in Vocational and Technical Education*, 5(13), 134-139.. https://doi.org/10.23977/avte.2023.051321

Woschke, T., Haase, H., & Kratzer, J. (2017). Resource scarcity in SMEs: effects on incremental and radical innovations. *Management Research Review*, *40*(2), 195-217.

Xing, F., Peng, G., Liang, T., Zuo, S., & Li, S. (2019). Managing changes initiated by industrial big data technologies: a technochange management model., 75-87. https://doi.org/10.1007/978-3-030-21935-2_7

Yang, J., Blount, Y., & Amrollahi, A. (2024). Artificial intelligence adoption in a professional service industry: A multiple case study. *Technological Forecasting and Social Change*, *201*, 123251.

Yang, P., Xiong, N., & Ren, J. (2020). Data security and privacy protection for cloud storage: A survey. *Ieee Access*, *8*, 131723-131740.

Yang, Z., Sun, J., Zhang, Y., & Wang, Y. (2015). Understanding SaaS adoption from the perspective of organizational users: A tripod readiness model. *Computers in Human Behavior*, *45*: 254-264.

Yen, D.C., Chou, D.C., & Chang, J. (2002). A synergic analysis for Web-based enterprise resources planning systems. *Computer Standards & Interfaces*, *24*(4): 337-346.

Zhang, W. (2022). Research on the construction of enterprise accounting data analysis platform based on cloud computing. Open Journal of Business and Management, 10(06), 3132-3141. https://doi.org/10.4236/ojbm.2022.106156

Zhang, Y., Xiong, F., Xie, Y., Fan, X., & Gu, H. (2020). The impact of artificial intelligence and blockchain on the accounting profession. *Ieee Access*, *8*, 110461-110477.

Zhu, K., & Kraemer, K. L. (2005). Post-adoption variations in usage and value of e-business by organizations: cross-country evidence from the retail industry. *Information systems research*, *16*(1), 61-84.