

ACCOUNTING DIGITALIZATION AND SOCIAL WELFARE: AN ECONOMIC UTILITARIAN PERSPECTIVE ON INDUSTRY 4.0

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Abstract: *The Fourth Industrial Revolution marks a point of reorganization in how technologies shape the economic, social, and political environments of global society. At the heart of this analysis is the reassessment of the role of accounting within socio-political-economic systems in the context of Industry 4.0. Against this background, economic utilitarianism proves to be a valuable tool for assessing the impact of these technologies. This article examines the complex interactions between the Fourth Industrial Revolution in accounting and socio-political-economic systems. The research reflects how the application of economic utilitarianism can reassess the moral, ethical, and legal dimensions of new technologies in accounting. Through case studies and theoretical model analysis, a comprehensive understanding of these dynamics is developed, providing academic insights and practical guidelines for the ethically responsible application of these technologies.*

Keywords: accounting, Industry 4.0, utilitarianism, ethics, regulation

JEL classification: M40, M42

Introduction

The Fourth Industrial Revolution represents a significant milestone in how emerging technologies are shaping the economic, social, and political environments of global society. This era of digital transformation, characterized by innovative advances in areas such as artificial intelligence (AI), blockchain, the Internet of Things (IoT), and Big Data, presents new challenges and opportunities for the traditional understanding of accounting and financial management (Tyagi et al., 2023; Al-Okaily et al., 2024, Fülöp&Topor, 2025). However, the extensive integration of emerging technologies in accounting raises questions about efficiency and effectiveness and the moral, ethical, and legal dimensions of their application (Tsoraya et al., 2023). At the heart of this analysis is the reassessment of the role of accounting within the socio-political-economic systems under the influence of Industry 4.0. The traditional boundaries and roles of accounting are expanding, promoting financial transparency and compliance and redefining strategic decision-making and risk management. These changes require a critical examination of stakeholders' underlying ethical premises and moral obligations (Shahib et al., 2020; Alam & Hossain, 2021; Odrekhivskyi et al., 2022, Fülöp et al., 2025a,b).

In this context, economic utilitarianism proves to be a valuable tool for assessing the impact of these technologies. Utilitarianism, with its basic principle of maximizing the common good, provides a framework for weighing the benefits of new technological applications against their potential risks and costs. In practice, this means that accounting decision-makers must consider not only the

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economic efficiency but also the social and ethical implications of their technological decisions (Haryanto & Sudaryati, 2020; Berrah et al., 2021; Pratama & Panghiarti, 2023).

The gaps identified based on the specialized literature, regarding the Fourth Industrial Revolution, highlight the way in which emerging technologies shape society at a global level. While traditional accounting methods often lag behind rapid technological advances, new technologies such as AI, blockchain, and data analytics are opening up unprecedented opportunities to improve financial reporting and transparency. These developments challenge the existing literature, calling for new standards and best practices to meet the complex demands of a digitized economy. At the same time, they offer opportunities for accounting transformation that transcend mere automation and assume a strategic role in the decision-making and governance of global companies.

This study examines the complex interactions between the Fourth Industrial Revolution in accounting and socio-political-economic systems. The research demonstrates how the moral, ethical, and legal aspects of new technologies in accounting can be reevaluated through the application of economic utilitarianism. A thorough comprehension of these dynamics is achieved by conducting case studies and analyzing theoretical models, offering scholarly insights and practical directions for the ethical implementation of these technologies.

1. Research methodology

The interview transcripts were analyzed using Braun and Clarke's (2006) thematic analysis method, a qualitative content assessment technique described by Mayring (2015). A qualitative content analysis is a systematic approach that follows explicit rules in order to interpret the linguistic material: “dissecting and processing it step by step, developing a system of theory guided by the theory of the material and defining in advance the analysis aspects” (O'Kane et al., 2021).

Based on recommendations from the literature and the small number of companies using these new technological innovations, ten interviews were conducted based on the method of Braun and Clarke (2006, 2019). Employees from firms that used invoice automation were chosen because they could relate their experience to innovation, technology, automation, and the benefits and drawbacks they encountered.

Data for the study were collected through ten semi-structured interviews with Romanian accountants. Convenience sampling was adopted by choosing existing contacts within the organizations to ensure sufficient interviews with appropriate informants. According to Braun and Clarke (2006, 2019), six interviews are required to obtain an appropriate non-probability sample.

The methodological design combines mixed methods of data collection, processing, and analysis (Figure 1).

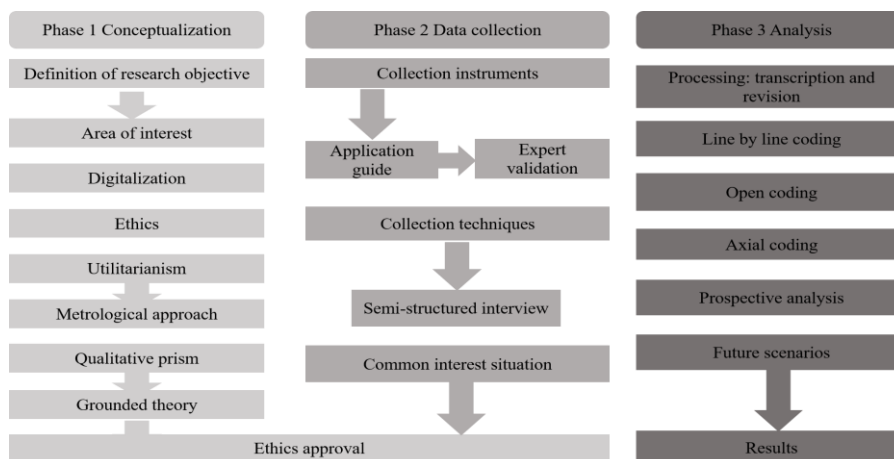


Figure 1. Research Methodology

Source: own design

2. Economic revolutions in the field of accounting

The Industrial Revolution brought about significant changes in the history of accounting. Each industrial revolution brought new technologies and operating methods that changed how companies managed and reported their finances (Tsoraya et al., 2023; Tyagi et al., 2023; Al-Okaily et al., 2024).

The Fourth Industrial Revolution, known as Industry 4.0, brings a new wave of digitization and networks that introduce significant changes in accounting. This revolution is characterized by the integration of technologies such as AI, machine learning, the IoT, blockchain, and Big Data. These technologies have the potential to fundamentally change the way accounting works, offering new methods of data processing, analysis, and security (Stearns, 2020; Bigliardi et al., 2020; Dai & Vasarhelyi, 2023; Martaseli & Maragita, 2023).

Accounting in Industry 4.0 is extremely complex and relevant, especially considering the rapid development of new technologies. The reevaluation of the moral, ethical, and legal dimensions of these technologies through the prism of economic utilitarianism offers an innovative perspective, significant both theoretically and practically (Haryanto & Sudaryati, 2020; Berrah et al., 2021; Pratama & Panghiarti, 2023). Moreover, the Fourth Industrial Revolution in accounting is also closely anchored to socio-political-economic systems, as it profoundly impacts the economy, society, and political system. These connections are evident in several key areas (Figure 2) that potentially transform accounting and socioeconomic structures (Shahib et al., 2020; Alam & Hossain, 2021; Odrekhevskyi et al., 2022).

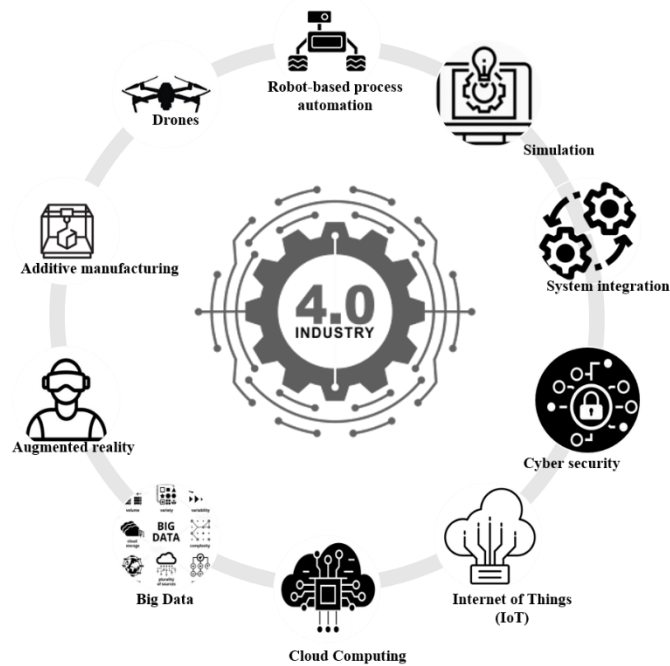


Figure 2. Emerging technologies specific to Industry 4.0.

Source: own design

Economic utilitarianism is a variety of utilitarianism that focuses on maximizing the common good or collective welfare. In the case of emerging technology, this means that choices must be made that balance short-term gains in efficiency or profit with considerations about long-term effects on the welfare of society as a whole (Posner, 1979; Weinrib, 1980; Gaffikin, 2007; Tweedie & Hazelton, 2019). The concept of utilitarianism bases ethical judgments about actions and rules on the benefits that result from their consequences. Thus, producing non-moral goods to satisfy the demand is deemed “morally good” because it generates widespread pleasure. Utilitarianism is, therefore, a teleological conception of ethics (Posner, 1979; Weinrib, 1980; Gaffikin, 2007). Economic utilitarianism represents the interplay between economics and ethics, navigating between the

utilitarian welfare function and bankruptcy. This concept, which integrates economics and philosophy, plays a significant role in understanding economic decisions and their impact on general welfare (Van Staveren, 2007).

In accounting, economic utilitarianism refers to the application of the principle of utilitarianism, which seeks to obtain the greatest possible benefit for the greatest number of people. In practice, this means that accounting decisions are made based not only on financial results, but also on their impact on society as a whole (Gaffikin, 2007; Dolfsma, 2023). Accounting decisions should examine social and environmental costs and benefits. This could cause companies to choose greener production methods or implement fairer labor practices, even if doing so increases costs in the short term. Crucially, the long-term societal benefits of these decisions may outweigh these costs (Orlitzky & Whelan, 2007; Jones, 2010; Adams et al., 2021). A utilitarian accounting approach would also promote transparency and ethical business practices. It would adopt fair and honest reporting practices and refrain from engaging in accounting fraud or other forms of fraud. Such activities may increase company profits in the short term but could prove to be harmful to investors, employees, and society in the long term (Haryanto & Sudaryati, 2020; Endenich & Trapp, 2020; Pong & Fong, 2023).

In contrast to those focusing solely on maximizing shareholder value, a utilitarian approach to accounting takes a broader stakeholder perspective. When making financial decisions, it is important to consider the interests of all stakeholders, from employees and consumers to local communities and even future generations (Jones & Felps, 2013; Morrison et al., 2018; Zimm et al., 2024).

Another aspect of economic utilitarianism in accounting aims to promote justice and equity by advocating a more equitable distribution of income and wealth within the firm and society. This can be achieved through progressive wage policies and fair bonus distributions (Li, 2018; Huang et al., 2024). One way to achieve this would be for companies to be required to report sustainability performance as well as financial results. The information they would be required to report would include how their operations affect the natural environment and the measures they had implemented to minimize negative impacts (Morrison et al., 2018; Todorovic, 2023). A utilitarian approach also requires identifying and managing potential risks to society resulting from operations and production processes at the company level. This can be achieved through more comprehensive risk analysis and reporting that transcends traditional financial and operational risks (Chen et al., 2022; Pong et al., 2023). Companies may use economic utilitarianism principles in their accounting practices to contribute to the advancement of a more equitable and environmentally responsible world. However, they should be aware that this frequently necessitates reconsidering corporate governance and possibly even redesigning standard accounting practices to reflect the true costs and benefits of their activities.

The integration of economic utilitarianism in digital accounting, especially concerning Industry 4.0, offers multiple opportunities to optimize decisions and processes to achieve the greatest possible benefit. This is appropriate at a time when technology makes it possible to use data and processes in innovative ways. Modern accounting systems enable comprehensive data analysis, enabling companies to make more informed decisions. By using Big Data and AI, companies can enhance their ability to make more accurate predictions and optimize decisions to maximize the overall benefit to the company and stakeholders (Serugga et al., 2020; Martin et al., 2021).

Accounting can become more efficient by automating routine tasks, allowing employees to focus on more complex and value-added tasks. As well as generating cost savings, this can increase job satisfaction and reduce human error, resulting in an overall improvement in social and economic well-being (Haryanto et al., 2020; Zhang et al., 2023). Digital accounting can also increase financial transparency. Through blockchain technology or similar secure digital ledgers, transactions can be tracked and verified, increasing the integrity of financial reporting and reducing fraud. Such transparency is essential so that companies can gain and maintain the trust of all stakeholders, including customers, investors, and regulators (Haryanto et al., 2020; Lehman, 2023).

Ethical considerations should be considered when using technology in accounting to ensure that decisions and processes enabled by technology are efficient but also fair, and accountable. For instance, financial forecasting or analysis algorithms should be free from bias and adhere to ethical standards during their development and implementation (Nasu, 2023; Pong & Fong, 2023).

An ethical digital strategy emerges from the company's vision. This is based on the business strategy and the company's core values, especially integrity. With such an inclusive strategy, the company can ensure that people, processes, products, and technologies remain within the boundaries of its digital ethics at every stage of the cycle. A modular framework forms the strategy process (Figure 3). The areas of responsibility can be adapted to the company's specific context (PWC, 2023).

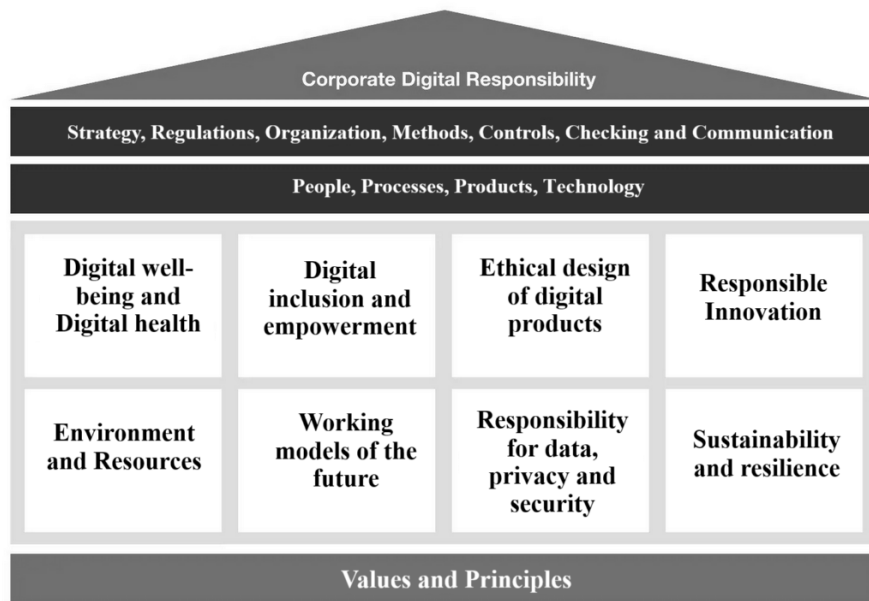


Figure 3. A modular digital ethics framework can be specifically integrated into corporate strategy and business processes.

Source: PwC, 2023

Regulatory aspects also play a significant role in the implementation and application of Industry 4.0 in accounting. Competitive regulations aim to make a business's location more attractive for investment and technological developments. This can be achieved through deregulation, tax incentives, research/development subsidies, or the creation of special economic zones, such as tax breaks. Such measures can accelerate the development of certain technologies within Industry 4.0, incentivizing companies to invest in certain technologies or processes.

At the international level, coordinated regulations aim to jointly address cross-border challenges. These include environmental protection, ethical standards, data protection, and network security. Such regulations can either slow down the pace of technological progress by imposing stricter criteria or accelerate it by facilitating the adoption of consistent standards. The primary purpose of these regulations, whether they are implemented through the promotion of competition or through international coordination, is social welfare. Although technological developments can lead to the creation of new jobs, they require the reskilling of existing workers. Moreover, as digitization expands, data protection and cyber security risks increase. Therefore, rules may play a crucial role in guaranteeing fair and equal access to technology while reducing disparities across different regions.

We note that the digital transformation of accounting, often called Accounting 4.0, has a significant impact on social well-being in both positive and potentially challenging ways. On the positive side, this leads to increased efficiency, improved data analysis, increased transparency, and

better access to financial services, promoting economic stability and growth. At the same time, it poses challenges such as job losses resulting from automation, a skills shortage, increased levels of risk for security and data protection issues, and inequality of access to technologies. Balancing this transformation is crucial to maximize social benefits and minimize negative impacts.

3. Results of the study

Interview guidelines with open-ended questions were developed for the interviews, which resulted in an open communication process in which it was decided which situational questions should be asked, what the individual priorities should be, and how the order of questions should be established. This approach allowed us to ask additional questions if there were any ambiguities or if certain aspects were not addressed directly by the interviewees. The interviewees consented to the interviews being recorded and transcribed in full. Before the interviews, the participants were assured that their identities would remain anonymous. Any references to individuals or companies in the interview transcripts were anonymized.

Table 1. Interview protocol

Interview	Position	Age	Experience	Interview duration
1	Employee in controlling department	30-35	10	22:10
2	Head of financial accounting	45-50	24	25:45
3	Employee in accounting department	25-30	5	17:37
4	Employee in accounting department	20-35	8	18:22
5	Income invoice responsible	40-45	15	22:25
6	Head of financial accounting	35-40	14	26:25
7	Head of financial accounting	40-45	18	23:15
8	Head of financial accounting	35-40	15	24:10

Source: own design

The individual interview transcripts were merged into a single document (145 pages), uploaded, and coded using Nvivo 12 software for qualitative content analysis (Mayring et al., 2019).

Digitization and digital transformation is a challenge in all industries. Ethics, both in a broad sense and specifically in relation to digital matters, are vital components of every occupation, including accounting. Furthermore, ethical conduct is of utmost importance in the accounting profession because it deals with individuals' and organizations' confidential financial data. The importance of ethics in accounting cannot be overemphasized. It plays an important role in maintaining the integrity and credibility of the profession. Therefore, we deemed it crucial to discuss this topic with our respondents in order to assess their position on ethics and the various aspects that interconnect with it.

RQ1: Importance of ethics in accounting

As we can see from the results, all interviewees were familiar with ethical aspects and their importance in the accounting profession (Table 2 and Figure 4).

Table 2. Thematic analysis nodes and references for RQ1

Sub-theme	Number of topic nodes	Frequency of referrals
Compliance with professional standards	4	65
Ensuring financial stability	3	32
Providing better services	3	39
Avoiding legal consequences	3	36
Maintaining public trust	3	38

Source: own design

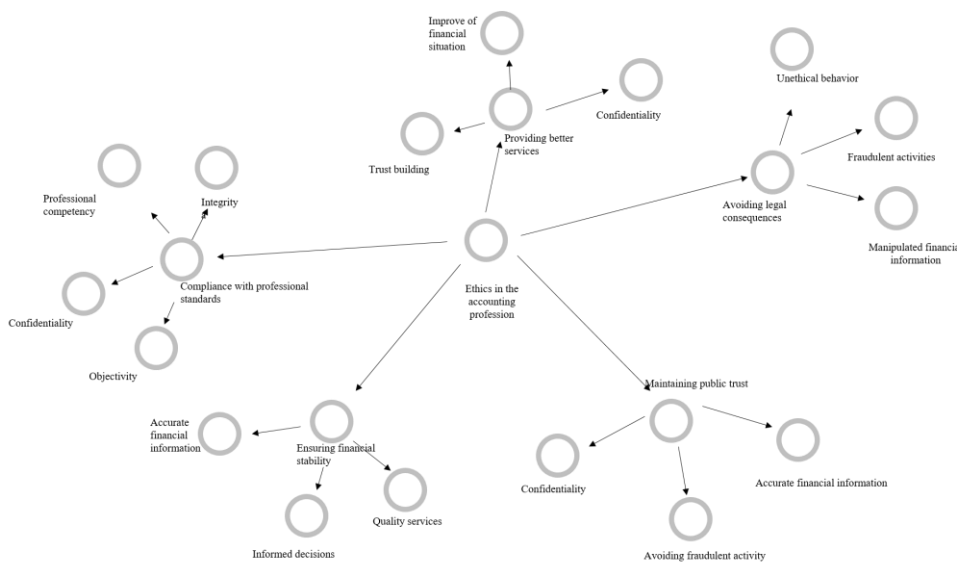


Figure 4. The importance of ethics: respondents' perspectives

Source: own design

In our discussions on ethics, the aspect that generated the greatest recognition and sparked the most debate was the commitment to professional standards. Maintaining professional standards and ethical principles such as integrity, objectivity, confidentiality, and professional competence was seen to be of the utmost importance. By adhering to these standards, companies can ensure that they provide reliable and accurate financial information to customers, stakeholders and the general public. Aspects analyzed in the specialized literature and also mentioned in the interviews (Shahib et al., 2020; Alam & Hossain, 2021; Odrekhivskiy et al., 2022; Tsoraya et al., 2023; Pratama & Panghiarti, 2023; Pong & Fong, 2023).

One of the respondents concretely pointed out his own vision regarding the results of digitization and ethics in a digitized system: “When we talk about digital ethics and digitization, many ask themselves the question: Will people be replaced? Do I see new things in old clothes or vice versa? For me, there is nothing disruptive about the image, rather, something old is preserved and merged with something new.”

One of the main reasons why accounting ethics is crucial is its significant contribution to maintaining public trust (Pratama & Panghiarti, 2023; Pong & Fong, 2023). Professional accountants are responsible for providing accurate financial information to their clients, and any unethical behavior can lead to a loss of confidence in the profession. If an accountant commits fraudulent activity, such as embezzlement, it can affect not only the client but also the reputation of the entire

accounting profession. *“Personal conversation is constitutive for the individual and society. Digitization can reinforce this. This is positive because communication is an essential characteristic of being human. If digitization didn't bring us benefits, we probably wouldn't have it.”*

Unethical behavior in accounting can also have legal consequences. Accountants who engage in fraudulent activities may be subject to criminal prosecution and may even lose their license. Additionally, the company they work for may incur legal consequences such as fines and reputational damage. By adhering to ethical principles, professional accountants can avoid such legal problems and protect themselves and their company (Tsoraya et al., 2023).

“Unethical behavior in accounting can not only significantly affect trust in a company, but can also lead to serious legal consequences. These can include fines, claims for compensation and even prosecution of those responsible. Such legal measures are intended to ensure that the integrity and transparency of financial reports are maintained and the interests of investors, customers and other stakeholders are protected.”

Ethical behavior in accounting is also crucial to ensuring financial stability. Accounting professionals are responsible for providing accurate financial information that helps companies make informed decisions. Without ethical behavior, financial information can be manipulated, which can lead to decisions that can harm the financial stability of the company. *“Adherence to ethical standards ensures that financial reports are fair and transparent, which increases the confidence of investors, customers and other stakeholders. This helps to minimize financial risks and create a strong economic base in the long term.”*

By adhering to ethical principles, accountants can improve their services to clients. If a professional accountant maintains confidentiality, it can help build trust with clients and encourage them to share sensitive financial information. Additionally, by providing accurate financial information, accounting professionals can help clients make informed decisions that can improve their financial situation (Shahib et al., 2020; Alam & Hossain, 2021).

The importance of ethics in accounting cannot be overstated. Adhering to professional standards, upholding public trust, avoiding legal ramifications, ensuring financial stability, and providing superior service are some of the reasons why ethical behavior is crucial in the accounting profession.

RQ2: The need for digital transformation in accounting

Digital transformation in accounting is necessary to increase efficiency and accuracy, to remain competitive, and to meet transparency and compliance requirements in an increasingly data-driven world (Table 3 and Figure 5).

Table 3. Thematic analysis nodes and references for RQ2

Sub-theme	Number of topic nodes	Frequency of referrals
Improving efficiency	4	42
Cyber security and data protection	4	39
View financial information in real time	3	27
Good collaboration	4	36
Data-driven decision-making	3	29

Source: own design

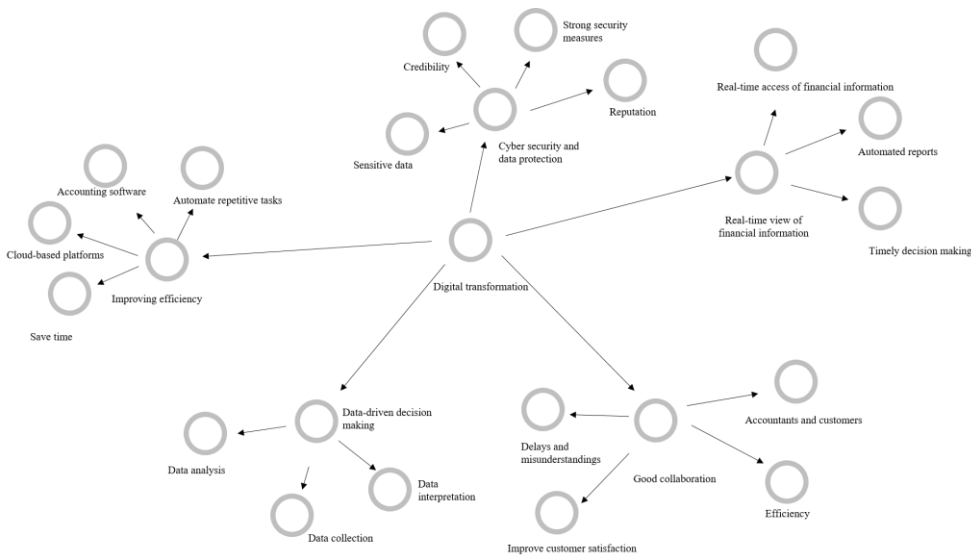


Figure 5. The need for digital transformation :respondents’ perspectives

Source: own design

In the ever-evolving digital world, it has become essential for the accounting profession to adapt and use emerging digital technologies. The rise of automation, AI, Big Data and cloud computing has revolutionized various industries, and accounting is no exception. Traditional manual processes and paper-based systems are no longer efficient and sustainable to meet the demands of an ever-changing business environment. The use of digital transformation in accounting not only optimizes processes, but also opens opportunities for growth, efficiency and greater customer satisfaction (Haryanto& Sudaryati, 2020; Berrah et al., 2021; Pratama & Panghiarti, 2023).

Digital transformation enables accounting professionals to automate repetitive and time-consuming tasks such as data entry, reconciliation and reporting. By using advanced accounting software and cloud-based platforms, accounting professionals can avoid manual errors, reduce paperwork, and save significant time (Stearns, 2020; Bigliardi et al., 2020). *“We should decide to transfer our fundamental values to the digital world. It is not these values that need to adapt, but rather the business models and technologies that need to adapt to the value system”*.

Digital transformation allows accountants to move away from traditional monthly or quarterly financial reporting and access real-time financial information. Using cloud-based accounting systems, accounting professionals can generate up-to-date reports, dashboards and KPIs in real time. This enables companies to make timely, informed decisions and adjust their strategies based on the latest financial information. *“I believe that digital transformation allows us to automate repetitive and time-consuming tasks such as data entry, reconciliation and reporting. This not only results in a significant increase in efficiency and accuracy, but also allows professionals to focus on more strategic and value-added activities. In this way, digitization contributes to improving overall productivity and strengthening the company's competitiveness”*.

Accounting solutions based on cloud computing enable seamless collaboration between accounting professionals and their clients. Cloud accounting allows accounting professionals and clients to securely exchange and work on financial information at the same time. This promotes effective collaboration, improves customer satisfaction, and eliminates delays and misunderstandings (Dai& Vasarhelyi, 2023; Martaseli & Maragita, 2023). *“Digital technologies for accounting solutions enable seamless collaboration between accounting professionals and clients. By easily exchanging data and documents in real time, accounting professionals can respond to client requests more quickly and accurately and provide customized financial solutions. This promotes closer and more*

efficient collaboration, increases customer satisfaction and contributes to long-term customer loyalty.”

Finally, digital transformation allows accounting professionals to harness the power of data analysis and make timely decisions. By collecting, analyzing and interpreting large amounts of financial data, accounting professionals can gain valuable insights into trends, patterns and business opportunities that were previously inaccessible. Advanced data analytics tools like Power BI enable accounting professionals to effectively visualize and present data, facilitate strategic discussions with management, and provide more relevant insights into the company's financial health.

With the ever-increasing expansion of digital technologies, cyber security and data protection are of the utmost importance. Accounting firms work with sensitive client data, and any breach can cause serious damage to their reputation and credibility. Therefore, it is essential that accounting professionals invest in robust cybersecurity measures such as encrypted communications, secure servers, and regular security audits.

In conclusion, we emphasize the statement of a respondent: *“I believe that the task of science is to discover developments at an early stage and to ask the right questions. In research, data analysts should deal intensively with the topics of ethics and quality of data processes. We are dealing with technologies for which we often do not know how the results they produce came about. Research still needs to provide many answers so that self-learning systems become transparent and predictable, and thus allow verifiable decisions. We also need an ethical debate: How do we want to control algorithms?”*

Conclusions

The application of economic utilitarianism in accounting and the evaluation of new technologies is the attempt to evaluate the costs and benefits of these technologies from a society-wide perspective. Evaluating the monetary and non-monetary costs and benefits associated with the introduction of new technologies is a first step toward the implementation of new innovative technologies in accounting. Challenges in applying economic utilitarianism lie in quantifying benefits and costs, especially ethical and social impacts, which are difficult to express in monetary terms. Evaluating new technologies using economic utilitarianism requires careful consideration of all dimensions – moral, ethical, legal, and economic. This approach can help develop a more comprehensive decision-making framework that transcends profit maximization and takes societal concerns into account.

Increased efficiency through automation and the use of emerging technologies such as AI and machine learning, accounting processes can be faster and more efficient. This leads to faster transaction processing and timely availability of financial data, which in turn improves decision-making in companies. The utilization of digital accounting technologies enhances the precision and clarity of financial reporting by promoting transparency and accuracy. Manual data entry errors are reduced and advanced analytics tools help identify irregularities and fraud. This consideration increases stakeholder and public confidence in companies' financial reports.

Accessibility and inclusiveness of cloud-based accounting software enable remote access to data and financial systems, making it easier for smaller companies or startups, in particular, to access advanced tools that would otherwise only be available to large companies. This can lead to a more democratic and inclusive economic environment. With the ability to process large amounts of data efficiently, companies can better document and communicate their sustainability efforts. This consideration contributes to the promotion of environmentally conscious and socially responsible actions.

In addition to a number of advantages, we also encounter a series of challenges. A challenge arises from the coordination between national interests and international standards, especially in a dynamic field such as Industry 4.0. In addition, regulations must be flexible enough to keep pace with

rapid technological progress without stifling innovation. Shaping regulations in the era of Industry 4.0 requires a fine-tuned balance between promoting innovation and protecting social and economic interests. Both competitive and internationally coordinated regulatory approaches are crucial in determining the implementation of technologies and their effect on social welfare.

Automating routine accounting tasks can lead to job losses, especially for low-skilled workers. This consideration emphasizes the need for retraining and continuous training of affected employees in accordance with the new areas of responsibility. With the increasing digitization of accounting, the risk of data breaches and cyber-attacks also increases. Protecting sensitive financial data is becoming increasingly difficult and requires robust security measures. While technologically advanced companies can benefit from innovations, smaller and less digitized companies risk being left behind. This can lead to a widening of the digital divide, which also exacerbates social and economic inequalities.

The use of AI and algorithms in financial reporting raises questions about ethical responsibility. Decisions made based on algorithms must be transparent and understandable to comply with ethical and legal standards. Thus, Accounting 4.0 offers numerous opportunities to increase efficiency and transparency and improve social welfare. At the same time, the associated challenges must be actively addressed to ensure that benefits are widely and equitably distributed and that negative impacts are minimized. A comprehensive political and organizational strategy is needed to maximize benefits while managing risks.

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