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A Two-Stage SEM–Artificial Neural Network Analysis of Integrating Ethical and Quality Requirements in Accounting Digital Technologies

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Abstract: Digital technologies affect all areas and activities of society. Accounting is no exception to this trend, as organizational information system accounting increasingly integrates digital technologies. The paper aims to study the integration of ethical requirements with the quality requirements in implementing digital technologies based on artificial intelligence, blockchain, the internet of things, and cloud computing in financial and managerial accounting. This empirical study of 396 accountants from Romanian organizations involves investigating the influence of ethical and quality requirements of digital technologies on the perception of users' satisfaction in financial and managerial accounting. Empirical research encompasses a quantitative approach using structural equation modeling and artificial neural network analysis in a two-stage procedure. Some of the existing ethical issues can be addressed by implementing new digital technologies but implementing these emerging technologies can generate other ethical and quality issues that accounting and IT professionals must address in a combined effort. The research results show that the ethical requirements that influence the perception of financial and managerial accounting are security and trust. Among the quality requirements, the most critical influence in the perception of accountants is reliability.

Keywords: ethical requirements; quality requirements; digital technologies; managerial accounting; IoT; artificial intelligence

Citation: Bocean, C.G.; Vărzaru, A.A. A Two-Stage SEM–Artificial Neural Network Analysis of Integrating Ethical and Quality Requirements in Accounting Digital Technologies. *Systems* **2022**, *10*, 121. https://doi.org/10.3390/systems10040121

Academic Editors: Ikpe Justice Akpan, Bamidele Adebisi and Murali S. Shanker

Received: 12 July 2022
Accepted: 9 August 2022
Published: 12 August 2022

1. Introduction

In current times, we live in an era of intense and accelerated digitalization, in which organizations need to adapt through an intensive process of change to meet customer requirements, integrating new digital technologies (DT) into their activities and processes. Furthermore, intense competition and the challenge of staying differentiated and competitive in today's marketplace have led organizations to become aware of the DT importance. Therefore, this reliable, transparent, and efficient production process incorporating DT represents an essential competitive advantage [1,2].

Artificial intelligence (AI), blockchain (BC), the internet of things (IoT), and cloud computing (CC) are four innovative systems from among new emerging technologies that are increasingly influencing organizational activities and processes [3]. The DT integration into the activities and processes of organizations generates several ethical issues while contributing to solving existing ethical issues before their implementation [4]. Financial accounting and managerial accounting (FAMA) are economic fields in which the DT implementation has a significant impact and can facilitate increased transparency, responsibility, and more remarkable performance in the decision-making process [1,3,5]. Moreover, accountants use DT in their activities. Therefore, their perception of the satisfaction resulting from their use is essential for accelerating these technologies' adoption [6]. Researching the influence of DT ethical and quality requirements on the perception of DT user satisfaction in FAMA is a research gap, which this paper aims to cover through an empirical study based on a proposed theoretical model. This paper aims to study the integration of ethical requirements with the quality requirements in implementing digital technologies based on AI, BC, IoT, and CC in FAMA. AI, BC, IoT, and CC technologies are essential components of the technological revolution 4.0 and show different degrees of development between developed and least developed countries and organizations depending on their size [7–9].

This article is structured as follows: First, we present a literature review after introducing the research theme. Then, the third section presents the research design and methodology. The following sections expose the research results, discussions, and conclusions. Finally, the paper concludes with the limitations of the research and the proposed future research directions.

2. Theoretical Background

Organizations' digital transformation in the context of the technological revolution 4.0 sets out a new vision of obtaining products and services with lower costs, higher quality, and that respect sustainability principles [10,11]. Moreover, digitizing organizational activities and processes is associated with introducing disruptive technologies (AI, BC, IoT, CC), which reshape an organization's functioning [12–15].

The digitization of the processes in the financial-accounting department aims to [16]: increase the operational efficiency by automating the processes, increase the real-time accessibility of accounting information, and increase the mobility within the accounting profession from any geographical area. In addition, digitization allows routine accounting activities to be performed by AI solutions, preventing human errors [17].

BC is a real-time decentralized and distributed network operations ledger [18]. Each actor in the network is a node that stores an accurate copy of this registry and the changes made, making it almost impossible to modify the registry entries because there would be differences between decentralized copies. Privileged users can no longer manipulate the registry [19]. Network nodes permanently validate the operations performed by others and post these validations in BC [20,21]. The registration becomes permanent and cannot be changed. This feature is due to the use of cryptography. The operations recording becomes permanent, and one or more nodes in the network cannot modify it. The amendment of the BC by only one of the parties invalidates it [19,22,23]. The reliability of BC lies in the fact that there is no one or multiple central nodes of the network and any of the nodes can operate and maintain the availability of the whole system [21,22,24].

Distributed ledger technology facilitates FAMA activities because the information no longer needs to be squared in multiple databases [25,26]. The information is available on the network, transparent, and enhanced security due to the multi-control performed by the network nodes. BC architecture allows for routine operations, while FAMA specialists can handle decisions that involve significant risks [20]. In addition to facilitating almost instantaneous information sharing, BC significantly minimizes human error [4]. BC technology introduced triple-entry accounting. Each operation resulting in classic debit and credit records of double-entry accounting are triangulated with a cryptographic hash, verifying the operation. Therefore, there is no need to validate an internal checker [19]. Even external auditing would be much easier, with visible and verifiable operations in real-time, and we would no longer need to sample accounting records.

Using BC, many aspects of professional accounting ethics can be verified. Autonomy, trust, safety, security, and responsibility increase the ability of FAMA specialists to make ethical decisions [26]. BC technology provides a high degree of security to all operations added as a block in the network [26]. The unique cryptographic hash invalidates any operation that would modify a block if the other actors in the network do not validate the operation. Cryptography generates a different hash calculation that invalidates the entire blockchain, so BC technology gives all stakeholders confidence in accounting operations and reporting [22]. BC provides security and safety through fast and real-time fraud detection. Accounting operations can be verified because every blockchain operation is sufficient accounting evidence. Finally, BC ensures continuous records monitoring, ensuring the integrity of accounting data [19].

BC information is accessible due to some features of incorporated AI to automate some processes. Programmable codes can create entries to retrieve information integrated into financial statements [6]. Thus, the financial statements provide transparency and traceability, generating confidence in the accounting ecosystem [27]. The public keys cryptographic verification method enhances the confidentiality of accounting data by BC technology. Accessibility can be controlled depending on the user category [6]. Autonomy is a feature of BC technology, as each node in the network reads, verifies, and updates operations, ensuring the accuracy of the posted data [19].

The internet of things (IoT) is technology that digitizes objects in the physical world. Through the sensors incorporated in the physical objects (assets, when we refer to accounting), values associated are transmitted in real-time to a central system [28,29]. Using the data associated with these assets, accountants can assess their condition, ensure proper maintenance and adapt the depreciation regime of assets to their actual wear and tear [6]. Introducing IoT into asset accounting includes continuously monitoring and evaluating assets and the possibility of human error, as data is shared directly between devices without an intermediary [30]. Given the low cost of sensors, data collected from multiple sources can give accountants a more comprehensive view of remote operations. True costs will replace the estimated costs in compiling budgets and allocating overheads, supporting objectivity and increasing the effectiveness and efficiency of decisions [31]. IoT technology will increase the objectivity and integrity of accounting records through the four specific features: real-time capabilities, ensuring interoperability; facilitating the digitization of physical assets and their characteristics, ensuring a high degree of autonomy of accounting operations; and decentralizing information [4]. Combined with the capabilities of AI solutions, IoT helps maintain auditors' objectivity, protecting the integrity of financial reports, and preventing unwarranted influences. [32] By digitizing and providing real-time information, IoT plays an essential role in managerial accountants' activity.

IoT has several features that capture a large and complex volume of data in real-time, provided in a CC system via wireless networks [33]. Other technologies, such as big data (BD), CC, AI, and wireless sensor networks, have improved IoT technology [2,33,34]. The challenges of loT technology are data standardization, interoperability between devices and a central server, data storage, processing, trust in the data provided, costs, confidentiality, and risk management [35].

AI technology can optimize and give the IoT device full autonomy. AI provides IoT decision-making capabilities based on analyzing data collected and processed. IoT and AI can increase the system's accuracy, reliability, and operational efficiency [34]. Security and privacy issues are also specific to IoT devices. Addressing and solving them also leads to increased user trust. Confidentiality of information, human privacy, and security are essential ethical requirements for IoT technology due to their mobility and complexity [34].

Artificial intelligence (AI) is a technology that allows predictions based on historical or real-time data and improves machine learning prediction models [36]. AI technology has been used in accounting since the 1980s [36] to perform complex analyses of financial statements [37], detect fraud [38], and help managerial accountants in predicting future performance [39,40]. In the 1990s, large audit firms made substantial investments in AI technologies to assist accountants and auditors in making decisions and validating accounting documents [5,41,42]. The preparation and revision of accounting records, data analysis, and decision support are tasks that can be taken over by AI technologies while strengthening internal controls for fraud detection [42,43]. However, there has been a fear that AI will replace the human factor in financial and managerial accounting. On the contrary, AI will not replace human resources in accounting but will increase the ability to explore complex data in real-time and assist in decision-making [26]. AI also contributes to the democratization of accounting expertise, providing accountants tools to conduct in-depth analyses, even if their experience is limited [44].

CC involves efficiently storing and managing a large amount of data [45]. Supply, production, storage operations, and fixed-assets accounting are associated with AI automatically in CC [45–47]. In addition, organizations can increase their efficiency and operational effectiveness by using the cloud by adopting effective risk management policies [48]. Carrying out accounting operations in a cloud allows public and fast, real-time access to accounting information. Furthermore, cloud accounting allows teleworking, and accounting information is available anywhere. Cloud accounting is a modern concept using CC operations as a medium [17].

The combined effect of the DT implementation in FAMA will increase the security and safety of data used in accounting, the transparency of financial statements, confidence in the information provided, the reduction of information asymmetry, the reduction of fraud by and distortion of financial statements, and the increase of the whole ethical level of accounting [4,6,49], thus freeing accountants from routine activities, allowing them to focus on essential accounting operations [25].

In combination with IoT technology collection processes, BC decentralized architecture will increase real-time accessibility and the reliability and security of data collected [30]. The introduction of AI elements in the BC blockchain allows many operations to be performed automatically without human intervention. Operations will be triggered automatically based on data provided by IoT, which highlights real-time asset status, authenticity, and security of operations [25]. By providing immutable evidence, enhanced with AI, BC-type technology can alert accountants, auditors, and other organization stakeholders when abnormal operations occur [20].

Cloud computing (CC) can help increase the efficiency and effectiveness of FAMA in combination with AI, BC, and IoT, facilitating accountants to share information with stakeholders in a secure way without the need for third-party verification. [50]. The environment where the operations will take place will be CC, ensuring the security by the characteristics of BC, and IoT provides the data. AI will provide complex data processing and support for accounting managers in decision-making [49]. One of the issues related to AI use and other information technologies in accounting is ensuring the ethical nature of decisions based on information provided by AI and other information technologies. Compliance with ethical requirements regarding the DT implementation in accounting is essential, as they increase the ethical level of management decisions [51–54].

Despite the benefits, DT use also involves several risks related to cybersecurity and safety [55,56]. For example, Yau-Yeung et al. [56] distinguish between six categories of risks: compatibility between hardware and software applications, the stability of the internet connection, server security, the reliability of financial statements, compliance with the law, and data ownership. Indeed, breaches of cybersecurity and safety are of great relevance in accounting [3,57,58].

The combined effect of digital technologies on the activities and operations of the FAMA will support the minimization of ambiguities and generate transparency and legitimacy of actions, making fraud more difficult by distorting financial statements [49].

Although a digital solution works accurately, it can fail if it does not meet the appropriate requirements [59,60]. Engineering requirements is often performed without regard to ethical concerns, leading to many ethical violations [61–63]. For example, the introduction by the developer of toxic requirements for fraud or incomplete requirements may lead to ethical breaches within the DT [60]. Ethical requirements must be integrated into quality engineering requirements processes to mitigate ethical issues. In the engineering phase of quality requirements, ethical requirements generate a better involvement of stakeholders, especially end-users.

Engineering requirements is the process of analyzing, specifying, validating, and maintaining the quality requirements of a system [60,64]. The improper identification of requirements can lead to defects in the specifications of an AI solution [65]. Improperly outlined requirements for DT can lead to ethical issues within FAMA, which affect various stakeholders. Considering the ethics in engineering, the quality requirements of DT solutions used in FAMA are essential, as it solves several existing ethical issues in accounting, preventing the ethical issues that may arise from the DT used in FAMA [66]. There is a close interrelationship between the engineering of quality and ethical requirements. In order to develop a practical and efficient DT in accounting, engineers should investigate technical and ethical issues. Therefore, the motivation of this research is to study the effects of integrating the quality requirements of the digital solutions used in FAMA with the ethical requirements, which derive from the specificity of accounting and the DT used in FAMA.

3. Methodology

3.1. Selected Variables, Hypotheses, and Methods

In developing digital technologies, engineering requirements are important activities that involve identifying user requirements, analyzing, specifying, and keeping up-to-date user requirements. In this paper, we aim to integrate the ethical requirements that arise from the DT implementation in FAMA with the quality requirements of users in accounting for these DT solutions. The ethical requirements of the DT solution implemented in accounting or audit involve designing the characteristics of the DT solution to respect a series of ethical principles related to the use of technologies and the purpose of using them in accounting and auditing [60,64,66]. Ethical issues must be acknowledged and solved in the design phase of the DT solution to avoid possible fraud or erroneous accounting records. Since the mid-2010s, digital ethics has been one of the topics that cannot be ignored in the design of DT solutions, and a series of analyzes have focused on inducing a positive impact of digital innovations and eliminating the associated risks [67].

Several authors inventoried the ethical requirements in the design and DT solutions implementation [67–72]. Table 1 shows the different ethical requirements that DT may face in the field of FAMA.

Table 1. Ethical requirements of DT in FAMA.

Ethical Requirement	Description
Transparency	Provides real-time information [70] to all stakeholders on accounting operations and decisions
Confidentiality	Proper and correct management of information [70]
Privacy	Ensuring non-intrusion into privacy through the use of AI solutions [69]
Safety	Safety of users using DT results [68]
Security	Security of information prior to DT implementation, as well as those arising from the adoption of the DT [72]
Correctness	Adoption of a fair decision in the event of conflicting requirements [70]
Responsibility	Explicit determination of shared responsibility between user and DT [70]
Autonomy	The ability of computers to make real-time decisions based on data without human involvement [67]
Trust	Ways to provide users with enhanced reliability by eliminating the risks of using DT [68]

Source: Own construction based on [67–72].

The quality requirements within DT are different from the quality requirements of a simple software product, involving many ethical issues related to the characteristics of DT. However, many ethical requirements go hand in hand with the quality requirements of the DT solutions used in FAMA, the two categories of requirements overlapping in certain aspects, given the need for ethical behavior in accounting. The quality requirements that do not intersect with the ethical requirements are maintenance (the ability of the DT solution to be modified and updated by correcting defects or improving the system) [73], interoperability (ensures a fluid connection between different DT and interaction between the various devices) [74], and reliability (ensures the robustness and the capacity of the system to manage the daily operations) [75].

Based on the other research results on DT solutions' ethical and quality requirements [67,73–77], we grouped DT quality and ethical requirements in FAMA into three categories: ethical requirements (ER); quality and ethical requirements (QER); and quality requirements (QR). Based on the literature review of the four technologies considered in this research (AI, BC, IoT, and CC) we found that the most frequently stated ethical and quality requirements are: security [19,20,25,26,30,34,49], confidence [4,6,22,27,35,49], and reliability [21,22,24,30,34]. Accordingly, we propose hypothesis H1:

Hypothesis H1. *Autonomy, security, and reliability are the most important antecedents in the three categories of ER, QER, and QR, according to DT users.*

Figure 1 shows the intersection between ethical and quality requirements.

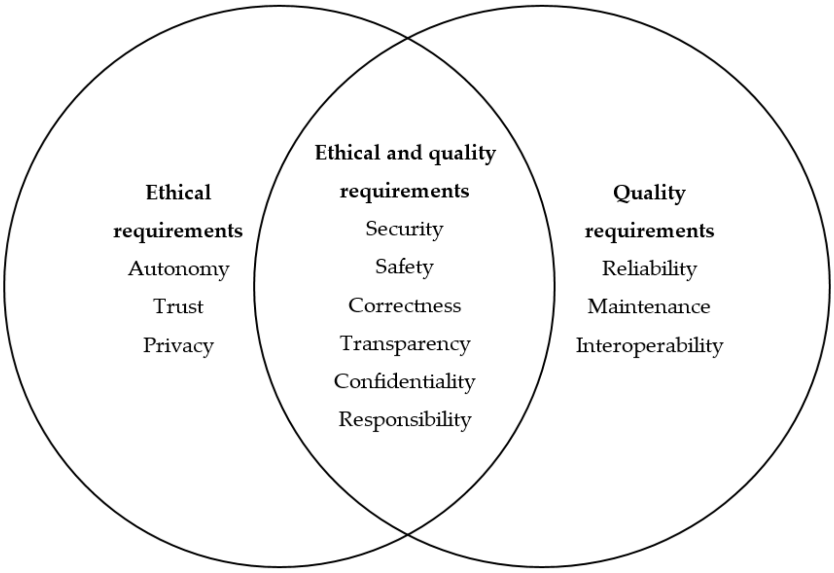

Figure 1. The intersection between DT ethical and quality requirements. Source: Own construction based on [67,73–77].

As shown in Figure 1, the common ethical and quality requirements are transparency, security, safety, confidentiality, and responsibility.

In the FAMA areas, the implementation of DT has a significant impact and can facilitate increased transparency, responsibility, and greater efficiency in decision-making [1,3,5]. The DT integration into the activities and processes of organizations generates several ethical requirements while contributing to solving existing ethical issues before their implementation [4]. Ethical requirements must be integrated into the engineering processes of quality requirements [60,64,65]. Ethical principles can generate a better involvement of stakeholders, especially end-users. Moll and Yigitbasioglu [6] consider that since accountants are the ones who use DT in their activities, their perception of the satisfaction of using DT is essential for accelerating the adoption of these technologies. Therefore, we propose hypothesis H2:

Hypothesis H2. *Ethical and quality requirements (QER) have the most substantial influence on the satisfaction of DT perceived by accountants.*

The satisfaction of DT end-users (accountants) implemented in FAMA in the research was established based on the proposals of Ngubelanga and Duffett [78], and two individual variables determine it: the extent of use and stated satisfaction. Ngubelanga and Duffett [78] proposed using TAM (Technology Acceptance Model) to evaluate the behavioral intention to use based on two components of the model: easy to use and usefulness. Our model did not use the TAM model because it aims to evaluate the behavioral intention to use. DT solutions are already in use and will expand in FAMA, regardless of the users' behavioral intention. Very important to FAMA is the assessment of how ethical and quality requirements can influence user satisfaction. The engineers can suitably design DT solutions implemented in FAMA based on these assessments.

Figure 2 illustrates the theoretical model that relates ethical and quality requirements to end-user satisfaction.

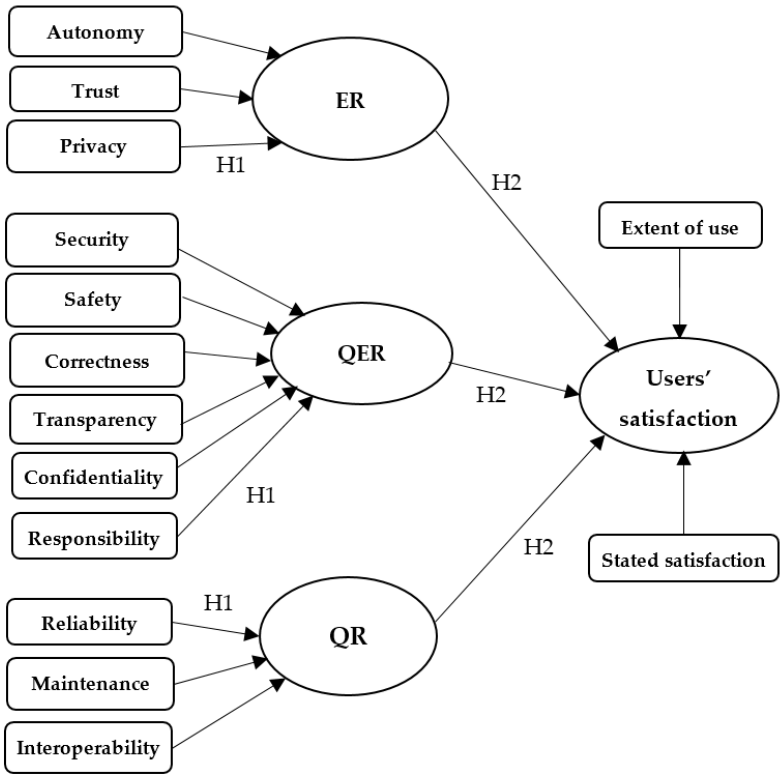

Figure 2. Theoretical model. Source: Own construction based on [2,43–55].

The model in Figure 2 allows the determination of the influence of one of the requirements categories (ER, QER, and QR) on the satisfaction of using DT by using structural equation modeling (SEM). Using SmartPLS v3.0 software (SmartPLS GmbH, Oststeinbek, Germany), we performed SEM in the partial least square variant. To determine the direct influence of individual ethical and quality requirements on the two individual variables that characterize the satisfaction of end-users of DT implemented in FAMA (the extent of use and stated satisfaction), we will use the analysis of artificial neural networks. Using SPSS v.20 (SPSS Inc., Chicago, IL, USA), we performed the analysis of artificial neural networks. Regarding the influence of individual variables on the satisfaction of DT end users, we formulate the following hypothesis based on the first two hypotheses:

Hypothesis H3. *Autonomy, security, and reliability are the individual ethical and quality requirements that significantly influence the satisfaction of DT users in FAMA.*

3.2. Selected Sample

To investigate the relationships between DT's ethical and quality requirements on the satisfaction of DT users in FAMA, we conducted a survey based on a questionnaire of 286 Romanian accountants who use DT in their FAMA operations to represent the sample research. Based on the procedure proposed by Dillman, the questionnaire was completed online [79] by 302 accountants from Romanian organizations. Sixteen questionnaires were not valid due to their incomplete delivery. The survey was conducted between March and May 2022. The valid response rate was 94.70%.

We used a Likert scale with five ethical and quality requirements levels in the questionnaire: 1 to 5 (1—not important, 5—most important). For the extent of use, we used a Likert scale with five levels were 1 to 5 (1—minimal extent, 5—considerable extent), while for stated satisfaction, we used a Likert scale with five levels: 1 to 5 (1—very low, 5—very high). Questionnaire design (constructs and items) is detailed in Appendix A (Table A1)

Table 2 shows the descriptive statistics for the model variables.

Table 2. Descriptive statistics.

Variable	Min	Max	Mean	Standard Deviation	Skewness	Kurtosis
Sex	1	2	1.46	0.499	0.155	−1.990
Age	1	3	2.04	0.753	−0.069	−1.227
Autonomy	1	5	3.79	0.998	−0.435	−0.670
Trust	1	5	3.63	1.057	−0.425	−0.433
Privacy	1	5	3.93	0.882	−0.519	−0.271
Security	1	5	3.70	1.036	−0.591	−0.163
Safety	2	5	3.92	0.881	−0.401	−0.619
Correctness	1	5	3.86	0.940	−0.542	−0.314
Transparency	1	5	3.70	0.862	−0.048	−0.589
Confidentiality	1	5	3.78	0.903	−0.479	−0.076
Responsibility	2	5	3.99	0.951	−0.514	−0.780
Reliability	1	5	3.80	0.964	−0.473	−0.394
Maintenance	1	5	3.58	0.972	−0.169	−0.654
Interoperability	1	5	3.81	0.878	−0.561	0.037
Extent of use	2	5	3.84	0.928	−0.305	−0.827
Stated satisfaction	1	5	3.41	1.212	−0.307	−0.810

Source: Own construction using SPSS v.20 (SPSS Inc., Chicago, IL, USA).

Within the SEM model, we defined the categories of ethical and quality requirements (ER, QER, and QR) and user satisfaction as latent variables. Questionnaire items represent observable exogenous variables.

The use of self-administered questionnaires can generate a problem that may affect the relevance of the research: the bias effect or common method bias—CMB [80]. Using Harman's single-factor test (in SPSS v.20), we tested all variables by exploratory factor analysis using principal component analysis. As a result, the total variance extracted was below 50% (46.505%), proving no substantial bias effects [80].

4. Results

The theoretical model was tested by SEM, partial least square variant, using SmartPLS v3.0 software (SmartPLS GmbH, Oststeinbek, Germany). We checked the outer loading of all exogenous variables, and all observable variables recorded values above 0.7. Figure 3 illustrates how the theoretical model was applied empirically.

Model reliability and validity measures record excellent values (Table 3), according to [81] Cronbach's alpha over 0.7, composite reliability over 0.8, and average variance extracted over 0.6.

Table 3. Validity and reliability.

	Cronbach's Alpha	Composite Reliability	Average Variance Extracted
ER	0.782	0.873	0.698
QER	0.881	0.910	0.627
QR	0.875	0.923	0.800
Users' satisfaction	0.888	0.947	0.899

Source: Own construction using SmartPLS v3.0 (SmartPLS GmbH, Oststeinbek, Germany).

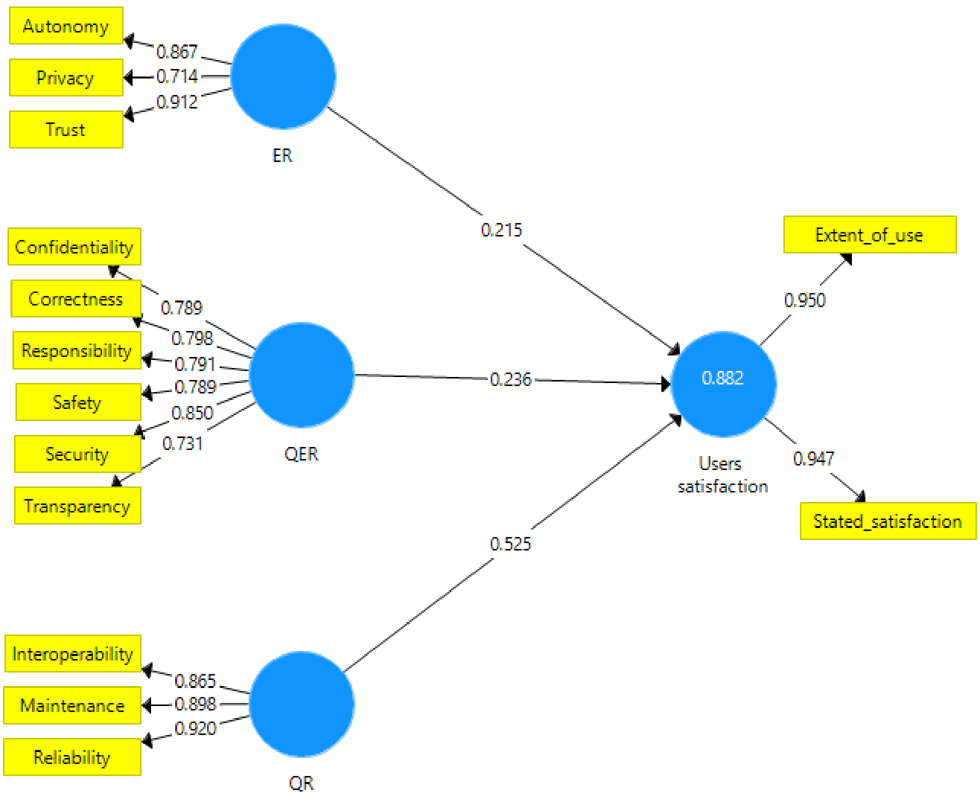

Figure 3. Applied model. Source: Own construction using SmartPLS v3.0 (SmartPLS GmbH, Oststeinbek, Germany).

To confirm the validity of the H1 hypothesis, we analyzed outer loadings (Table 4) for the antecedents of the latent variables that characterize ethical and quality requirements: ER, QER, and QR.

Table 4. Outer loadings for ethical and quality requirements.

Category	Requirement	Outer Loadings
ER	Autonomy	0.867
	Trust	0.912
	Privacy	0.714
QER	Security	0.850
	Safety	0.789
	Correctness	0.798
	Transparency	0.731
	Confidentiality	0.798
	Responsibility	0.791
QR	Reliability	0.920
	Maintenance	0.898
	Interoperability	0.865

Source: Own construction using SmartPLS v3.0 (SmartPLS GmbH, Oststeinbek, Germany).

Trust (0.912), security (0.850), and reliability (0.920) have the highest outer loading in each of the three categories (latent variables ER, QER, and QR), which confirms the H1 hypothesis as valid.

The model path coefficients calculated using a bootstrapping procedure are shown in Table 5.

Table 5. Path coefficients.

Path	Original Sample	Standard Deviation	T Statistics	p Values
ER - > Users' satisfaction (H2)	0.215	0.056	3.856	0.000
QER - > Users' satisfaction (H2)	0.236	0.046	5.087	0.000
QR - > Users' satisfaction (H2)	0.525	0.058	9.042	0.000

Source: Own construction using SmartPLS v3.0 (SmartPLS GmbH, Oststeinbek, Germany).

We are analyzing the path coefficients in Table 5. On the satisfaction of using DT perceived by accountants, the most substantial influence is exerted by QER, followed by ER and QR, with significant influences (over 0.2) and relatively equal. Therefore, the H2 hypothesis is confirmed to be valid.

To confirm the validity of the H3 hypothesis, we used the analysis of the artificial neural networks, which allowed us to establish the relationships between variables located in two layers, the input layer (ethical requirements and quality requirements), and the output layer (extent of use and stated satisfaction) [82]. The model chosen to test the H3 hypothesis was the multilayer perceptron. We chose a hyperbolic tangent function as an activation mechanism for the hidden layer, while we chose a sigmoid function for the output layer. The rescaling method for co-variates was normalization. The average overall relative error of the model was 0.203 in the training phase and 0.200 in the testing phase. Figure 4 shows the multilayer perceptron model applied to ethical and quality requirements related to the extent of use and stated satisfaction by the DT users in FAMA.

Figure 4 illustrates the positive influence (synaptic weights > 0) of the variables from the input start (ethical requirements and quality requirements) on variables from the output layer (extent of use and stated satisfaction). Table 6 details the predictors of the multilayer perceptron built to establish the relationships between input variables (ethical requirements and quality requirements) and output variables (extent of use and stated satisfaction).

Table 6. The predicted values of the multilayer perceptron.

Predictor		Predicted Values				
		Hidden Layer 1	Output Layer		Importance	Normalized Importance
		H(1:1)	Extent of Use	Stated Satisfaction		
Input Layer	(Bias)	−0.733				
	Autonomy	0.014			0.009	2.3%
	Trust	0.260			0.191	47.7%
	Privacy	0.006			0.004	1.0%
	Security	0.097			0.066	16.5%
	Safety	0.008			0.005	1.3%
	Correctness	0.134			0.093	23.3%
	Transparency	0.047			0.031	7.8%
	Confidentiality	0.049			0.033	8.3%
	Responsibility	0.021			0.014	3.5%
	Reliability	0.518			0.400	100.0%
	Maintenance	0.185			0.131	32.9%
	Interoperability	0.034			0.023	5.7%
Hidden Layer 1	(Bias)		−0.351	−0.366		
	H(1:1)		5.000	4.632		

Source: Own construction using SPSS v.20 (SPSS Inc., Chicago, IL, USA).

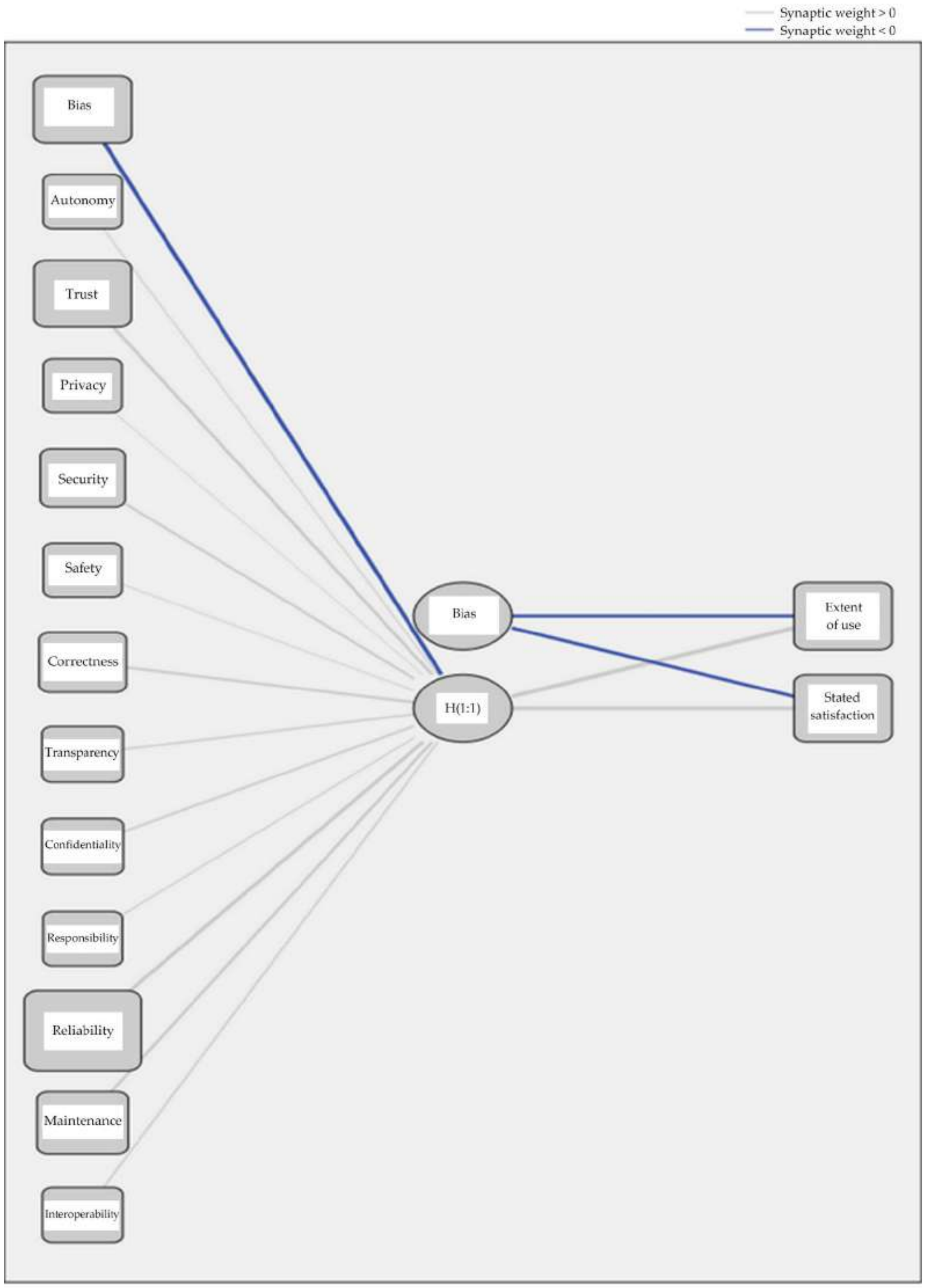

Figure 4. Multilayer perceptron regarding ethical and quality requirements. Source: own construction using SPSS v.20 (SPSS Inc., Chicago, ILUSA).

The analysis of the values for the variables in the input layer (ethical and quality requirements) concludes that hypothesis H3 is partially validated. The individual influence of ethical and quality requirements on the extent of use and stated satisfaction by the DT users in FAMA exercised is significant in relation to biases. The most substantial positive influences are exercised by reliability, trust, and maintenance, with security in fourth place. All variables exert positive influences while external biases negatively influence the extent of use and stated satisfaction.

5. Discussion

DT implementation will discourage unethical, aggressive behaviors in accounting operations and the construction of financial statements by automatically activating ethical rules [83]. DT use will strengthen the ethical level of decisions, providing accountants with solid support in the decision-making process. DT implementation will increase the ethical awareness and moral intent of the accountant [4,6], improve the decision-making process [84], and substantially reduce the risk of fraud [85].

Over time, using AI in combination with other information technologies will massively reduce the risks of data manipulation and ethical misconduct, and assisting decision-makers will reduce costs and increase efficiency and effectiveness [25]. Accountants' reluctance to implement DT in the FAMA stems from the belief that adopting these technologies will lead to the disappearance of jobs [25]. The use of DT in FAMA will determine the transition from accounting governance to intelligent governance, in which the decision-making process is supported by AI, secured by BC, and powered by IoT data in a CC medium [4].

One problem with DT is sharing responsibility between man and machine [6]. Currently, AI technology has several limitations, lacking several characteristics that only human resources have so far: self-control, self-awareness, and self-motivation [54]. Moreover, implementing ethical principles is automatic and dehumanized within AI, leading to manipulations by those who program or reprogram AI. Therefore, the integration of ethical and quality requirements is essential.

The results of this paper (H2 hypothesis) suggest that organizations can use ethical guidelines for DT solutions in FAMA to identify and prioritize the essential quality requirements of DT solutions. Although similar to [60,63,64], we believe that ethical requirements must be integrated into quality engineering requirements processes, and ethical principles can generate better stakeholder involvement. The literature review results [67,73–77] concluded that the ethical requirements for DT solutions in FAMA are trust, responsibility, autonomy, transparency, confidentiality, privacy, security, and security correctness. Some of these (transparency, confidentiality, privacy, security, safety, correctness, and responsibility) are also quality requirements, adding specific quality requirements of DT solutions in FAMA (maintainability, interoperability, and reliability). In line with the findings of other authors [4,6,19–22,24–27,30,34,35,49], we found that the most frequently stated ethical and quality requirements are security, trust, and reliability DT used in FAMA (H1 hypothesis). Analyzing the direct influence of these ethical and quality requirements on the extent of use and stated satisfaction by the DT users in FAMA (H3 hypothesis), we reconfirmed the results obtained with reliability, trust, and security, adding another technology-specific quality requirement: maintenance.

The DT integration into FAMA will lead to substantial changes, such as reengineering accounting procedures, increasing quality by reducing errors and information distortions, and improving the efficiency and effectiveness of the decision-making process [86]. In addition, the results of this research are helpful to those organizations aware of the need to combine the knowledge of MA with the new DT, allowing them to gain a competitive advantage and increase accounting and financial performance.

The main risks regarding the ethical and quality requirements identified by the researchers who studied the DT implementation in FAMA [87,88] are lack of trust, reluctance about reliability, confidentiality, privacy, accessibility of information, and essential features of the accounting system.

6. Conclusions

The adoption of digital technologies will help increase the accuracy and transparency of accounting operations, which will increase the ethical level of FAMA. In addition, the combined effect of digital technologies by combining their features (security, security, trust, confidentiality, autonomy, reliability, accuracy, accessibility, real-time capabilities, authenticity, and responsibility) will provide an ethical framework for collecting, processing, interpreting data, providing information, providing alternatives for decision-making, or even for direct decision-making.

6.1. Empirical and Practical Implications

In this paper, we investigated accountants' perceptions of the ethical and quality requirements by combining effects associated with DT implemented in the FAMA field on the satisfaction of using DT in the FAMA field. Ethical issues related to implementing DT solutions in FAMA are essential, given the importance of ethics in accounting. However, few studies analyze the link between the ethical issues of DT solutions in FAMA and the quality requirements. Some of the existing ethical issues can be addressed by implementing new DT, but implementing DT can lead to other ethical issues that accounting and IT professionals must address through a combined effort. The main ethical and quality requirements, which are the strengths of DT and which influence the perception of the satisfaction of DT users in FAMA, are reliability, trust, security, and maintenance. Accountants and auditors want a reliable DT solution that users trust, which does not require special maintenance, and offers information security guarantees. Designers must focus more on these requirements. The research results are confirmed by other research results, which state that DT will radically transform FAMA [1,86]. The consideration of ethical and quality requirements in designing optimal DT solutions is essential in this area for increasing financial and organizational performance.

6.2. Theoretical Implications

The DT used in FAMA has already generated substantial tangible benefits in increasing the ability of accountants to collect, process, and interpret complex data, facilitating the prevention of intentional and unintentional fraud. Until AI has similar characteristics to human intelligence, AI decisions or AI-based reasoning decisions must be transparent to ensure correctness and objectivity.

A disadvantage of DT is the still high cost, making these technologies restrictive, as small and medium-sized enterprises cannot quickly implement them. In addition, the beneficial effects of network integration will fade by limiting the access of many businesses to these technologies [49]. Another disadvantage is the ethical aspects of the confidentiality of data obtained through IoT. Organizations must obtain the written consent of the persons involved regarding digital technologies' possible breach of privacy. Finally, the DT implementation presents several possible risks or inconveniences that employees must adjust to [4]. The design of DT solutions that comply with the ethical and quality requirements requested by accountants and auditors is essential in FAMA. The paper offers a theoretical and practical way of integrating the ethical and quality requirements of DT solutions in FAMA, proposing a theoretical model that is empirically tested.

6.3. Limitations and Further Research

Starting from the limit on the sample composition only from Romanian specialists in FAMA, for future research, a potential direction would be to consult specialists from other countries to portray the differences arising from national culture and the specificity of FAMA. In addition, one direction of future research may be to investigate the ethical issues specific to each type of digital technology (AI, BC, IoT, and CC) used in FAMA, given the different characteristics and ethical issues specific to each type of technology.

Author Contributions: Conceptualization, A.A.V. and C.G.B.; methodology, A.A.V. and C.G.B.; software, A.A.V. and C.G.B.; validation, A.A.V.; formal analysis, A.A.V. and C.G.B.; investigation, A.A.V.; resources, A.A.V.; data curation, A.A.V. writing—original draft preparation, A.A.V. and C.G.B.; writing—review and editing, A.A.V. and C.G.B.; visualization, A.A.V.; supervision, A.A.V.; project administration, A.A.V. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Table A1. Questionnaire design (constructs and items).

Variables	Items	Scales
Demographic variables	Gender Age	Male (1), Female (2) 18–30 years (1), 31–45 years (2), 46–65 years (3)
ER	Autonomy Trust Privacy	1 to 5 (1—not important, 5—most important)
QER	Security Safety Correctness Transparency Confidentiality Responsibility	
QR	Reliability Maintenance Interoperability	
Users' satisfaction	Extent of use Stated satisfaction	1 to 5 (1—minimal, 5—maximal extent) 1 to 5 (1—very poor, 5—very good)

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