DEVELOPING A MATURITY MODEL TO IDENTIFY DIGITAL SKILLS AND ABILITIES OF ACCOUNTING PROFESSIONALS: EVIDENCE FROM TURKEY

Reşat Karcioğlu¹, Fatih Ömür Binici²

¹Atatürk University, Erzurum, Turkey
² Ağrı İbrahim Çeçen University, Ağrı, Turkey

e-mails: ¹rkarci@atauni.edu.tr, ²fobinici@agri.edu.tr

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ABSTRACT
The digital transformation process has led to the spread of new and advanced technologies in business environments. This situation has affected the accounting profession as well as many professions and has created new opportunities and risks. The biggest risk that arises is that accounting professionals must have up-to-date digital skills to stay relevant in the field. Determining the current digital skills of accounting professionals is important to meet this requirement and constitutes the source of motivation for the study.

Objectives: The aim of this study is to investigate the level of digital abilities and skills that will enable accounting professionals to use current and advanced technologies developed as a result of digital transformation.

Methods/Approach: This study used a survey method to collected data from 279 professional accountants working in Turkey’s leading industrial companies. The collected data was analyzed to develop a maturity model for digital skills and abilities.

Results: According to the findings of the study, professional accountants have a high level of maturity in the technologies they use. However, there is a lack of talent and skill in emerging and evolving technologies that are not currently widely used in the workplace. This study benefits accounting educators, those with accounting career goals, and the development of digital skills and abilities in accounting professionals.

Keywords: Digital competencies, Digital transformation, Accounting, Maturity model

JEL classification: M15, M40, M41, O33

Paper type: Research article


INTRODUCTION
This study examines the level of digital competencies and skills that accounting professionals have for to enable them to make use of current and advanced technologies introduced by digital transformation. The results of the study will help determine these abilities and skills, provide information about the current situation but also allow to identify the deficient digital competencies and skills. The study aims to further identify the technologies used in business environments. Collective assessment of the results expected to be derived with this method will not only give an idea about the digital competencies and skills that should be gained by accounting academicians to those willing to study accounting but also will enable people pursuing career goals. Digital transformation process has improved the abilities of technology (Linde & Petrova, 2018; Geldiev et al., 2018; Uteubayev et al., 2018; Zagorodnya et al., 2020).

² Corresponding author, Fatih Ömür BINICI, fobinici@agri.edu.tr, This study was produced from Fatih Ömür Binici’s doctoral thesis.
Thus improving abilities of technology have further affected business environments to the highest extent and brought flexibility and efficiency to business environments. In this respect, it forces business environments to be restructured (Stohr & Zhao, 1997: 2). Restructuring is perceived in every process within the company. Accounting processes that assume a critical role (Lim, 2013) in the information supply chain is also included in this context (Schiavi et al., 2020). Consequently, the process has revealed new dilemmas, perceived needs and possibilities for accounting practices (Bhimani & Willcocks, 2014).

Emerging and rapidly developing mega technology trends such as “Cloud Computing, Robotic Process Automation (or RPA), Machine Learning, Artificial Intelligence (or AI), Internet of Things (or IoT), Big Data and Blockchain” (Certified Public Accountant (CPA), 2019) caused significant changes with regard to the topics that the accounting profession is interested in, where it works and the way it works (Bhimani & Willcocks, 2014). A vast majority of the routine and repetitive accounting tasks that accounting professionals generally complain about have recently been fulfilled by emerging and constantly developing technologies (Gullkvist, 2011; Carlsson-Wall & Strömsten, 2018). Digital workflows that are environmentally friendly and cost-effective, that respond faster to needs and expectations, that use less resources and provide maximum efficiency have become preferred rather than traditional paper-based processes (Lazarova, 2019).

Although AI-based software robots rather provide assistance in non-routine tasks, they have recently become increasingly involved in highly complex tasks such as detecting fraud and liquidity planning (Leitner-Hanetseder et al., 2021). Performing inspections with drone technology, managing financial transactions with the blockchain, interacting with stakeholders and customers through social media and leveraging big data to aid analysis and interpretation (International Federation of Accountants (IFAC), 2018) have become newer trends. Furthermore, owing to the wider adoption of mobile and digital technology by businesses and governments have caused primary tasks such as tax returns to be filed online. Recent developments are expected to cause accounting professionals to perform more value-added tasks such as financial management and data-driven decision making (Zhang et al., 2018). Accounting professionals need to think differently and laterally about what the future of their careers might look like and to reshape their traditional business structures (Association of Chartered Certified Accountants (ACCA), 2020). Assuming new roles that necessitate broader skills rather than traditional roles (Kend & Nguyen, 2020) urges accounting professionals to acquire the skills and abilities to support the adoption and application of advanced technologies (Kokina & Blanchette, 2019; Taiwo, 2016). The significance of traditional accounting skills once required to be employed has gradually been decreasing in the current business environment (ACCA, 2016). These traditional abilities and skills have been replaced by new competencies such as the ability to use and apply new technologies, to understand, design and use new accounting systems using the latest technologies (Stoner, 2009; Senik & Broad, 2011; Siddoo et al., 2019). These skills have more frequently been sought by employers and they have already taken place as key competencies in the skills spectrum that is generally emphasized by professional organizations, academicians and researchers (Kotb et al., 2019; Cory & Pruske, 2012). However; considering the fact that the current accounting curriculum, which is the primary factor affecting the acquisition of certain
abilities and skills, is not dynamic enough to timely meet the rapid changes in the business environment (Kotb et al., 2019) and lags behind developments in the business environment (Awayiga et al., 2010) accounting professionals’ IT competencies and readiness for the challenges in the business environment still raise concerns (Damasiotis et al., 2015; Bahador et al., 2018; Hayes et al. 2022). Moreover, no consensus has been reached yet on what to teach and how to teach (International Accounting Education Standards Board (IAESB), 2018). Therefore, as accounting curriculum has not been revised in parallel with technological developments, the abilities and skills of the professionals employed in the field of accounting are still criticized by many employers (Cory & Pruske, 2012; García & Ríos, 2021; Rîndașu, 2021). Accordingly, there is a constant call for the integration of information systems and technological competencies into the accounting curriculum (Sledgianowski et al., 2017) for to ensure the accounting curriculum to serve the technical skills, knowledge and competence required by the industry (Dimitrov, 2022) and to timely respond to technological advances in the market to increase the employability of new graduates (Qasim & Kharbat, 2020).

In this respect, we hope that this study significantly contributes to the accounting literature. It will further help to assess the current status of the digital competencies and skills of accounting professionals and to identify the deficiencies and points that need improvement. The technologies used in practice and the graduates will be aware of the technologies they will encounter when they meet the business environment. (Daff, 2021). Collective assessment of the results will provide concrete evidence to accounting academicians about which digital technologies should be included and taught in the accounting curriculum. maturity models were developed to achieve the objectives of the study.

Literature Review
Roles offered to accounting professionals with digital transformation
Digital transformation have caused accounting professionals to assume senior managerial and consultant roles who can take strategic decisions and earn higher income rather than the traditional roles they have undertaken so far in the business environment such as “Record Holder” (Yaşar, 2019), “Information Producer” (Xu, 2003) or “Knowledge Workers” (Bahador & Haider, 2012). On the other hand, Kokina et al. (2021) concluded in their study that accounting professionals play important roles as Identifiers, Explainers, Trainers, Sustainers and Analyzers of their organizations’ automation initiatives in technology applications and they further noted that accounting professionals need to acquire new technical competencies in order to get prepared for assuming these five roles. Similarly, IFAC has published an “Adaptive Cycle” report in 2019 explaining the changing roles of accounting professionals in the face of developing trends. The report discussed seven key roles such as a “Co-Pilot, Navigator, Brand Protector, Storyteller, Digital and Technology Enabler, Process and Control Expert and Trusted Professional” suitable for the future of the business world and allowing the accounting professionals to maintain their integrity with their institutions over the next decade and continue to increase their contribution to organizations, financial markets and economies. The report published by ACCA in 2020 on the expected future accountancy careers for accounting professionals (Future Ready: Accountancy Careers
in The 2020) envisages five prospective careers as “assurance advocate, business transformer, data navigator, digital playmaker, sustainability trailblaze”. International Federation of Accountants (IFAC), one of the professional accountancy organizations, initiated the studies on the competencies of accounting professionals in information technologies in 1985 and the first report was published in 1996. The published International Education Guide (IEG) 11 states that Information Technologies (IT) have currently been used extensively and that accounting professionals will soon become IT users, designers, managers or evaluators.

**Significance of information technologies for accounting professionals after digital transformation and suggestions**

Creating human resources with the competencies required by digital transformation has received limited scientific attention (Warner & Wäger, 2019: 326). There are limited studies on how to find human resources with new abilities and skills and how to develop the competencies of these human resources (Guinan et al., 2019: 717). In addition, current accounting curriculum is not dynamic enough to timely meet the rapid changes in the business environment (Kotb et al., 2019) It lags behind the developments in the business environment (Awayiga et al., 2010). The accounting curriculum needs to be updated periodically in the light of current developments and employer expectations.

Owing to digital transformation, professional abilities and skills have recently paled into insignificance while identifying the opportunities and strategic options by using digital and data technology to add value and using the appropriate technologies and tools have become the prominent abilities and skills in professional life (ACCA, 2020). Although these requirements have been frequently mentioned in recent years, the development of technology-related abilities and skills has been realized with the integration of the computer (Palmer et al., 2004). In the years when the computer was just emerging, Firmin & Linn (1968) revealed that accounting requires new knowledge and skills such as mathematics, statistics, information technologies and behavioral sciences along with the use of new tools and methods that will increase functionality. Another study conducted by Boss (1969) investigated the impact of electronic information processing on the career of accounting professionals. This study emphasized that development is possible in four areas: behavioral science, electronic computers, mathematical tools and techniques and scientific methods. Throughout the years when the computers were first introduced, accounting professionals did not adequately focus on this issue, they did not consider the computers striking and they even hesitated to address the new competence needs until the 1970s (Doost, 1999). Watson (1990) and Hostrom & Hunton (1998) concluded that accounting professionals should understand the interrelationship of processes, technologies and information systems in the future. They also emphasized that accounting professionals need knowledge in three areas related to information systems technology, concepts and operations. Kaye & Nicholson (1992) found that accounting academicians and students should develop high-level information technology competencies. For the purpose of the study conducted by Lee & Blaszczyński (1999), questionnaires were sent to 166 companies. Results from these questionnaires revealed that the significance of accounting knowledge for entry-level accounting graduates
has decreased over time, while computer skills, communication skills and group skills have been sought after. Bush (2001) found that 96% of accounting professionals in The United States of America (USA) have access to the Internet and that Internet offers more opportunities for accountants. Chen et al. (2009) observed that accounting graduates are expected to be able to use and interpret financial statements, business graphics, word processors and other software assisting presentations, audit, tax filing, small business systems, database management systems, accounting and communication at an expert level. Bahador et al. (2012) argued that accounting professionals are required to enhance their technical skills and competencies concerning analysis and design, programming languages, specific software, General Business Information Systems, data base and data communications, advanced applications, computer systems, system theory and concepts, Information Technology Management, operating systems and network systems. Lawson et al. (2014) categorized accounting competencies into three groups as “core competencies”, “general management competencies” and “accounting competencies”. Elsaadani (2015) stated that newly graduated accountants should be literate in internet, word processing softwares, spreadsheet software, e-mail, business accounting software and database management software. Pan & Seow (2016) further suggested that accounting professionals should acquire competencies related to technologies such as forensic tools, XBRL, analytics and data mining. Tsiligiris & Bowyer (2021) also recommend that accountants are required to acquire the skills related to processing, organizing and auditing a wide variety of data.

Further studies in the literature (Chang & Hwang, 2003; Burnett, 2003; Wessels, 2005; Lange et al., 2006; Kavanagh & Drennan, 2008; Awayiga et al., 2010; Cory & Pruske, 2012; Abayadeera & Watty, 2014; Tam, 2013; Belfo & Trigo, 2013; Sithole, 2015; Pan & Seow, 2016; Turker, 2018; Allahverdi & Karaer, 2019) suggested that advanced IT competencies and beyond are the most important driving force that accounting professionals are expected to have in the future concerning their changing roles. Suriarti (2020) concluded that there has been a certain change concerning the roles of accounting professionals over time and this role change has caused a shift in the hard and soft skills that an accountant should have. The same study further argues that data analysis, data collection and the use of collected data for business decisions and the ability to interpret data will be new areas of expertise expected from the accounting professionals.

The results of the literature review published by IFAC in 2018 revealed that smartphone applications, cloud computing, big data, Bitcoin and blockchain, artificial intelligence (AI) and drone technology have a profound impact on business processes when considering the future of the accounting profession. It has further been stated that there is now a greater focus on data analytics, research skills, programming skills and statistics to provide ICT competencies. “Digital Transformation in Finance Functions: 2-Association of Southeast Asian Nations (ASEAN) and The United Kingdom (UK) Perspectives” report published by Institute of Chartered Accountants in England and Wales (ICAEW) in 2019 strongly emphasized that widespread adoption of digital solutions requires a major cultural change, thereby consumers and businesses need serious training. It was further argued that education is crucial for accounting professionals to understand what technology is, what they can do using the technology and how they will make use of technology. In addition, various stakeholders
including governments, trade and industry associations, professional institutions and authorities need to cooperate on this issue. ACCA identified, in its 2020 competency framework, 12 areas of skills and abilities that accounting professionals of the future will need to advance their careers and add more value to employers and clients. It was highlighted therein that new graduate accountants who have recently been introduced to the profession or professional accountants who keep up with their professional life will need to identify opportunities and strategic options using digital technologies and data technology (which can also be defined as “Digital Capabilities and Skills” to add value) and use appropriate technologies and tools to innovate and gain advantage. Considering the significance of IT starting from the Industrial Revolution 4.0, Competency Framework published by the Malaysian Institute of Accountants (MIA) in 2019 states that the relevance and knowledge of IT will need to be applied in various knowledge domains. The Chartered Global Management Accountant (CGMA) published a Digital Competencies Framework in 2019 including the knowledge and digital literacy, digital content creation, problem solving, data strategy and planning, data analytics and data visualization aiming to help the management, accountants and their employers understand the information requirements and assess the skills and abilities required for both current and desired roles. Furthermore, International Accounting Education Standards Board (IAESB) published the International Education Standard 2 (IES 2) in 2019 covering specific IT technical competencies required for accounting students to complete higher education before entering the profession. The Institute of Chartered Accountants in England and Wales (ICAEW) published a framework in 2018 which identifies the abilities increasingly expected from finance professionals that will enable organizations and individuals to integrate the required broader functional and business skills with data science skills. In 2019, ACCA surveyed members and affiliates on their level of understanding various terms such as artificial intelligence (AI), machine learning (ML), natural language processing (NLP), data analytics and robotic process automation (RPA). The results indicated that, on average, 62% of respondents had never heard of any of the terms, heard the term but didn't know its meaning or had only a basic understanding of the terms. Only 13% of participants claimed to have a “high understanding” or “expertise” in these terms.

Integration of digital technologies into accounting curriculum

Universities and accounting courses have recently accelerated their efforts to incorporate technology into their curricula (Qasim & Kharbat, 2020). In the study conducted with a random sample of 103 business schools from 50 states in the USA, Wang (2021) found that 50 percent of the undergraduate level schools and 86 percent of the post graduate schools offered courses on analytics or emerging technology. Queen Mary University in United Kingdom has started teaching courses on how to discover the patterns in finance and accounting. The University of Waterloo in Canada added core analytics courses to its undergraduate and post graduate programs whereas the Southern University of Finance and Economics in Chendu, China has established a bachelor’s degree program for business analytics in accounting including disciplines such as databases, data mining, data analytics, machine learning and basic accounting knowledge (Zhang et al., 2018).
Singapore Management University and USC Marshall School of Business offered master's degree programs in Data Analytics and Accounting whereas St. Mary's University (Texas, USA) offered a bachelor’s degree program in Accounting and Data Analytics with courses such as accounting, data analytics, information systems management and quantitative management while the University of Pittsburgh offered a master’s degree program in Accounting and Business Analytics (Stanciu et al., 2020). Furthermore, there is a wide variety of studies that focus on developing curricula and different teaching strategies or exercises with suggestions on how universities or courses might address accreditation requirements for the prevalence of this situation (Wang, 2021; Lawson et al., 2014; Buchheit et al., 2018). For instance, Association to Advance Collegiate Schools of Business (AACSB) which provides quality assurance, business education acumen along with learning and development services to business schools worldwide published the standard A5 including the ability of both faculty members and students to adapt to developing technologies as well as the ability to master the current technology. On the other hand, the fact that there is a large segment of digital immigrants who do not have the necessary hardware and skills infrastructure for accounting academicians creates controversy and raises problems that need to be solved urgently (Stanciu et al., 2020: 205). Technology provides academicians with new opportunities and benefits in educational practices, however there is still a significant number of faculties which resist adopting new technologies. For the purpose of a study conducted by Watty et al. (2016) in Australia, it was concluded that the resilience of 93% of the accounting professors interviewed constitute a key barrier to the adoption and use of technology. The faculty's resistance to the inclusion of technology in the accounting curriculum and the instructors’ unwillingness to learn new technologies or software (Andiola et al., 2020: 5) were investigated by Kearns (2014). This research suggested that the deficiency of qualified accounting instructors equipped with an information technology background may be the reason for the failure of integrating information technologies into accounting curriculum.

Assessment with regard to the accounting professionals’ abilities and skills
Digital transformation served to develop various conceptual frameworks and corresponding measurement tools to prepare existing professionals of all disciplines for this process and to comprehensively clarify what digital competences include (Cattaneo et al., 2021). There are various international organizations and faculty members in the accounting discipline which have recognized this need and presented certain IT qualification frameworks for a number of modern accounting roles (e.g. Damasiotisa et al., 2015; Lawson et al., 2014) and a self-assessment tool to help in professional development (e.g. Certified Practising Accountant Australia-CPA Australia; Institute of Management Accountants-IMA; the Institute of Chartered Accountants of India-ICAI; Lebedev, 2019; Bahador et al., 2018). However, there are still gaps in the academic literature on the current digital maturity levels of accounting professionals (Lebedev, 2019). Addressing this gap is important in order to identify the needs that will prepare accounting professionals for business environments in the future. In this context, Bahador et al. (2018) evaluated the IT abilities and skills of accounting professionals using the maturity model. As a result of the study, evidence has been put forward asserting that accounting professionals
have a low level of maturity in using technologies such as IT security, Enterprise Resource Planning System (ERP) and IT governance. There are further studies stating that accounting professionals do not have the expected advanced IT competencies and knowledge (Ahmed, 2003; Damasiotisa et al., 2015; Luo et al., 2018; Rindaşu, 2021; Dimitrov, 2022).

It is necessary to identify the deficiencies of these abilities and skills in addition to taking into account new technologies in the current industry practices (Qasim & Kharbat, 2020). IFAC (2018) specified that technology has the potential to affect the work that accounting professionals carry out in the workplace and the nature of the services they provide as well as the knowledge, behavior and skills they need to successfully perform their tasks. New technologies and automation further affect the exchange between generations, the work done, the workforce used and the place where the work is done (Kaplan, 2018). For the purpose to evaluate this situation, Wessels (2006) researched for the existence of new and advanced technologies in the South African business environment, emphasized that these technologies did not play a significant role in the business environment and suggested that accounting professionals should acquire skills and abilities appropriate to the current business environment and thereupon made suggestions for the accounting curriculum. In its study covering companies incorporated in Germany or quoted on the stock exchange, KPMG (2017) concluded that the vast majority of companies are still in the midst of a digitization process in accounting and only 15 percent of the participating companies are digital pioneers. Luo et al., (2018) stated that the implementation of artificial intelligence in the field of accounting in China is still in the start-up phase. Similarly Leitner-Hanetseder et al. (2021) argued that the use of AI-based digital technologies has already been at an early stage, Buchheit et al. (2020) noted that the use of data visualization technology among local accounting firms are rather low, Bakarich & O'Brien (2021) explained that both Robotic Process Automation and Machine Learning have currently not widely been used by public accountants or their clients and Sestino et al. (2020) stated that Big Data has business potential however it is still in its early stages of evolution outside of the engineering sciences.

There are further studies on the abilities and skills that accounting professionals will need in the future. For instance, Schmitz & Leoni (2019) emphasized that advanced IT knowledge and skills, such as data analytics, are clearly inadequate among accounting professionals but will become widespread in the future. Therefore accounting professionals and auditors will need to acquire technical knowledge about blockchain-based smart contract solutions and related technologies such as Artificial Intelligence. Likewise, Aguiar et al. (2021) concluded that RPA and Artificial Intelligence were used at a low rate.

**METHODOLOGY**

*Research Design*

The focus of this study is to identify the current digital competencies and skills of accounting professionals and the maturity level of the technology used in business environments. Maturity model (the details with regard to the implementation are presented under the heading “Sample and Data Collection”) were developed
by the authors. The “Digital Ability and Skills Maturity Model (DAS)” aiming to ascertain the current status of accounting professionals. The research question determined in line with the aims of the study are as follows: RQ1. What is the maturity level of digital competencies and skills of accounting professionals and does this differ based on demographic variables?

Development of Maturity Models

The concept of maturity model was originally introduced by the “Software Engineering Institute” at Carnegie Mellon University as an instrument for objectively evaluating the ability of government contractors to perform a contracted software project. Although the concept initially focused on software development, it has been successfully applied in other areas and has taken its place among the process development models known as Capability Maturity Model Integration (CMMI) (Karrigan, 2013). The Digital Maturity Model is a gradual reference model that enables the evaluation and improvement of levels in the digital transformation and/or digital service abilities of an organization's competence in pre-defined competence areas to the targeted or required level (The Scientific and Technological Research Council of Turkey-TUBITAK, 2017). The maturity model consists of a set of maturity levels for a class of objects. These objects represent an expected, desired or typical evolutionary path formed as discrete stages. Typically, these objects are organizations or processes. The lowest level represents an initial state that can be characterized by an organization with a lower ability in the field of question while the highest level represents the concept of maturity (Becker et al, 2009). The development of maturity models consists of several stages. For example, De Bruin et al. (2005) proposed a six-stage method: “determining the scope and purpose, designing the model, creating the contents, testing the model, implementation and continuous improvement”. To develop the maturity model in this study, the steps suggested by De Bruin et al. (2005), Becker et al. (2009) and Marx et al. (2012) were followed.

Step 1: Literature, reports of the international professional organizations and competence frameworks (Table 1) were referred to create item pools of maturity models.

| Table 1. Resources Used for Designing Maturity Models |
|---------------------------------|------------------|
| **Maturity Model Design** | **Sources** |
| Design | De Bruin et al. (2005), Becker et al. (2009), Marx et al. (2012) |
| Strategy | Becker et al. (2009), Sternkopf & Mueller (2018) |
| Sources used when creating models | Education Handbook contains the IAESB-(IFAC-2019) competency framework—(CGMA -2018) |
| | Competence Framework – (ACCA -2019) |
| | De Villiers (2010); Van Deursen et al. (2014); Pan & Seow (2015) |
| | KPMG 2017 |
| Measurement | Schumacher & Sihn (2020) |
| Level | Van Deursen et al.(2014) |

Source: created by the authors.

“Digital Ability and Skills Maturity Model (DAS)” was developed by the authors taking into account the competence frameworks published by professional organizations. DAS Model was developed with 5 abilities and skills as “Digital Literacy Basic Level (DLB)”, “Digital Literacy Advanced (DLA)”, “Data Analysis and
Data Visualization (DAV), “Digital Strategy and Vision (DSV), “Problem Solving (PS)” and 41 items measuring this ability and skills were determined. (Table 1)

**Step 2:** For the purpose to provide assurance that the items created for the models (checklist, questionnaire, or scale) measure the expected content, the content validity ratio (CVR) of the determined items was assessed using the Lawshe method (Lawshe, 1975). Expert opinions were sought for the purpose of Lawshe method, accordingly forms containing the items were sent to 13 experts to express their opinions. 8 experts agreed to express their opinions for the content validity study. The expert committee, who agreed to express their opinions, consisted of lecturers, instructors, software developers and accounting experts. Experts were asked to code each item as “1- Item is necessary”, “2- Item is necessary but not sufficient” and “3- Item is unnecessary”. Considering the number of experts, the critical cutoff value of the CVR was determined as 0.750 (Ayre & Scally, 2014) at the $\alpha=0.05$ significance level. In line with the expert opinions, 9 items prepared for DAS that were below the CVR value were excluded from the pool.

In general, a likert type scale is used to calculate the maturity level of maturity models. To determine the maturity level of maturity models using a Likert-type scale, the size or general maturity level is calculated by using the answer given to each item and the weight determined for the item (Blatz et al., 2018). For the purpose of the DAS model developed to evaluate the digital competencies and skills of accounting professionals, a 6-point likert scale (0=No Idea, 1=Beginner Level, 2=Basic Level, 3=Intermediate Level, 4=Advanced Level, 5=Expert Level) were preferred.

**Step 3:** The draft models derived at the end of the content validity study were applied to the accounting professionals between March-June 2020 for testing the validity and reliability of the study. At the end of the application, valid responses were obtained from 319 participants (146 men and 173 women). The Kaiser-Meyer-Olkin (KMO) criterion was used to test the suitability of the obtained results for factor analysis and the Bartlett's Test of Sphericity (Table 2) were applied to test the homogeneity of variances between the collected data (Quinn et al., 2020).

<table>
<thead>
<tr>
<th>KMO and Bartlett Sphericity Test Result</th>
<th>DAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kaiser-Meyer-Olkin Measure of Sampling Adequacy Approx. Chi-Square</td>
<td>0.914 4977.920</td>
</tr>
<tr>
<td>Bartlett Test of Sphericity Df. Sig.</td>
<td>231 0.000</td>
</tr>
</tbody>
</table>

Source: created by the authors.

The KMO values higher than 0.80 and significant values at the $p<0.05$ level in the Bartlett’s test (Quinn et al., 2020) calculated for the models reveal that the data are suitable for factor analysis. Once the data has been determined to be suitable for factor analysis, “Exploratory Factor Analysis (EFA)” was used to discover the sub-dimensions for the development and adaptation of the scale for both DAS model and whether these models were validated on the researched sample was tested using “Confirmatory Factor Analysis (CFA)” (Hurley et
al., 1997). SPSS data analysis software (version 22) was used to examine the validity of the scales and the AMOS module (version 21.0) was used to confirm the models’ fit. Varimax rotation method was used for factor analysis. 10 items in the model were removed from the draft as a result of EFA, as their factor loads remained below 0.40. Consequently, the DAS model was finalized with 22 items under 5 factors (Appendix 1). Non-standardized Cronbach's Alpha values, which are widely used to determine the reliability of the factors, is a good internal consistency measure and present the degree of correlation between the construct and its criteria (Sheikhshoaei et al., 2021) were taken into account. The higher the Cronbach's Alpha value indicates that the instrument will be more reliable for measuring the structure (Amirrudin et al., 2021). Cronbach's Alpha value was found to be greater than 0.7 (Adamson & Prion, 2013) for both models. CFA, which is used to test the fit of the model in general, is the value calculated by dividing the Chi-Square value which is one of the most basic measurements by the degrees of freedom ($\chi^2$/df- CMIN/df). If the CMIN/DF value is ≤ 3, it indicates an acceptable fit whereas the value ≤ 5 indicates a reasonable fit (Rezaei et al., 2020). As a result of the analysis (Table 3), the $\chi^2$/df value which is a measure of model fit was calculated as 2.55 for the DAS model. These values indicate a good fit. The Root Mean Square Error of Approximation (RMSEA) value, which gives information about how well the mass is compatible with the covariance matrix, is expected to be between 0.03 and 0.08. The RMSEA value for DAS model is calculated to be > 0.07. Other calculated values were also found to be in accordance with the suggested fit index results (Table 3).

Table 3. Model Fit Indices Calculated for DAS Model

<table>
<thead>
<tr>
<th>Fit Indexes</th>
<th>Fit Indexes of Models</th>
<th>Recommended Fit Index Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\chi^2$/df</td>
<td>2.553</td>
<td>≤ 3; ≤ 5 (Rezaei et al., 2020)</td>
</tr>
<tr>
<td>RMSEA</td>
<td>0.070</td>
<td>≤ 0.08 (Rigdon, 1996)</td>
</tr>
<tr>
<td>GFI</td>
<td>0.877</td>
<td>≥0.9; ≥0.8 (Lei et al., 2017; Rezaee &amp; Jafarib, 2016)</td>
</tr>
<tr>
<td>CFI</td>
<td>0.936</td>
<td>≥ 0.90; ≥ 0.95 (Rezaei et al., 2020; Rezaee &amp; Jafarib, 2016)</td>
</tr>
<tr>
<td>NFI</td>
<td>0.900</td>
<td>≥ 0.9 (Lei et al., 2017)</td>
</tr>
<tr>
<td>IFI</td>
<td>0.936</td>
<td>≥ 0.9 (Rezaei et al., 2020)</td>
</tr>
<tr>
<td>TLI</td>
<td>0.922</td>
<td>≥ 0.9 (Lei et al., 2017)</td>
</tr>
<tr>
<td>SRMR</td>
<td>0.064</td>
<td>≥ 0.08 (Lei et al., 2017)</td>
</tr>
<tr>
<td>AGFI</td>
<td>0.837</td>
<td>≥ 0.9 ; ≥ 0.8 (Lei et al., 2017; Rezaee &amp; Jafarib, 2016)</td>
</tr>
</tbody>
</table>

Source: created by the authors.

**Step 4:** Equation (1) developed by Schumacher and Sihn (2020), and presented below was used to calculate the maturity score. Equality takes into account the scores obtained from the item ($g_i$) and the weights of the items ($f_i$)) Item scores are calculated based on the responses to a Likert-type scale

$$M = \frac{\sum_{i=1}^{n} g_i \cdot f_i}{\sum_{i=1}^{n} g_i}$$

The weights of the items were determined using the Step-Wise Weight Assessment Ratio Analysis (SWARA) method which takes into account the opinions of the experts. SWARA ensures that experts’ views on the importance of qualifications are included in the rational decision-making process (Keršuliene et al.,
The weights of the items in the item pool of this study were included in the planning while taking expert opinions for the calculation of the CVR. Experts were asked to prioritize the items determined for each ability and skill. The experts were informed about the model before the evaluation. The item weights calculated for the DAS model in line with the evaluation of expert opinions revealed that the items with the highest weight refer to having the ability and skill of “data analysis and data visualization” (Table 4).

### Table 4. Item Weights Calculated for DAS Model

<table>
<thead>
<tr>
<th>Item No</th>
<th>Item Weight</th>
<th>Item No</th>
<th>Item Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>0.103</td>
<td>5</td>
<td>0.034</td>
</tr>
<tr>
<td>11</td>
<td>0.094</td>
<td>22</td>
<td>0.031</td>
</tr>
<tr>
<td>16</td>
<td>0.087</td>
<td>19</td>
<td>0.028</td>
</tr>
<tr>
<td>15</td>
<td>0.079</td>
<td>4</td>
<td>0.026</td>
</tr>
<tr>
<td>13</td>
<td>0.071</td>
<td>3</td>
<td>0.024</td>
</tr>
<tr>
<td>14</td>
<td>0.065</td>
<td>18</td>
<td>0.022</td>
</tr>
<tr>
<td>10</td>
<td>0.058</td>
<td>21</td>
<td>0.021</td>
</tr>
<tr>
<td>3</td>
<td>0.052</td>
<td>20</td>
<td>0.020</td>
</tr>
<tr>
<td>8</td>
<td>0.046</td>
<td>17</td>
<td>0.019</td>
</tr>
<tr>
<td>7</td>
<td>0.042</td>
<td>2</td>
<td>0.017</td>
</tr>
<tr>
<td>6</td>
<td>0.037</td>
<td>1</td>
<td>0.016</td>
</tr>
</tbody>
</table>

Source: created by the authors.

### Step 5: The maturity levels corresponding to the maturity scores for both models, as used in the “Competency Measurement Model” developed by Russo (2016) for labeling the maturity levels, were labeled in 5 steps (Table 5). The descriptions provided with regard to the levels indicated that the “lowest level” was labeled as “limited”.

### Table 5. Maturity Levels Set for DAS and Corresponding Descriptions

<table>
<thead>
<tr>
<th>Score Range</th>
<th>Maturity Levels</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-0.99</td>
<td>Limited</td>
<td>• Has limited knowledge at this level. Is less collaborative and not open to technological development.</td>
</tr>
<tr>
<td>1-1.99</td>
<td>Basic</td>
<td>• Can use technology to perform accounting processes. (non-integrated software) • Uses Office Software. • Can communicate with the help of technology.</td>
</tr>
<tr>
<td>2-2.99</td>
<td>Intermediate</td>
<td>• Is aware of the technologies that affect his/her profession. • Uses integrated accounting software. • Has advanced knowledge of excel. • Can detect problems that occur when using technology.</td>
</tr>
<tr>
<td>3-3.99</td>
<td>Advance</td>
<td>• Can use advanced technology. Can obtain the necessary accounting data owing to advanced technology. • Uses data visualization software. • Can use data management techniques. • Can ensure data security. • Can determine the technological requirements. • Can suggest advanced technologies for accounting applications.</td>
</tr>
</tbody>
</table>
Expert

- Can take measures to prevent problems that arise while using technology.
- Can improve data processing processes.
- Can supervise advanced technological applications.
- Can develop learning strategies in parallel with technological development.
- Is open to continuous improvement.

Source: created by the authors.

Accounting professionals evaluated at this level have limited knowledge. They were found to be less collaborative and not open to technological developments. Highest level of maturity is described as “experts”.

Sample and Data Collection

The target population of the study is the accounting professionals employed at all levels in the accounting departments of enterprises listed in the “Turkey’s Top 1000 Industrial Enterprises” announced by the Istanbul Chamber of Industry (ISO) in 2019. Information with regard to the number of employees in these enterprises is not provided. Therefore, considering that at least one person is employed in accounting departments, the sample size was determined as 1000. Model application was also carried out with more than one employee from the same enterprise. The size of the universe was determined as 1000 accounting professionals in total (N=1000). The sampling method was used in the research as it will be difficult in practice to reach all the accounting personnel of the mentioned enterprises. The sample size for the models was determined as 286 (Please see: Israel, 1992) in accordance with 95% confidence interval and a 5% margin of error. Detailed information about the model was provided to the participants before the implementation. A website (https://abilitygo.com/model/) was designed for the implementation of the maturity models. Information with regard to the implementation of the models was provided to the participants via the website. In addition, a questionnaire form was prepared using Google forms. The people included in the sample (about 5000 people) were contacted and the questionnaire link was shared by phone or e-mail as they were working from home due to the Covid-19 pandemic. 279 (N=279) accounting professionals participated in the DAS Model implementations respectively.

RESULTS

Results with regard to the Digital Ability and Skills Maturity Model (DAS)

Mean digital ability and skills maturity score calculated in accordance with the answers given by each participant to the first question (RQ1) of the questionnaire prepared for DAS maturity model implementation was “2.61”. Mean total maturity score of the accounting professionals revealed the average maturity level as “Intermediate”. This result, in general, indicates that the accounting professionals included in the sample required to attain advanced digital abilities and skills to reach a higher level of maturity. Pursuant to the scores obtained from the abilities and skills included in the DAS model (Table 7); the “Digital Literacy Basic Level (DLB)”, which covers the digital competencies related to the basic technologies that accounting professionals have already adopted and are widely used (Tsiligiris & Bowyer, 2021), was found to be the ability and skills in which accounting professionals have the highest maturity with a score of 4.17. The item that the
participating accounting professionals scored the highest was “I know the general working principles and structure of Microsoft Office Programs (Powerpoint, Excel, Word etc.)” with a score of 4.26.

### Table 7. Total Maturity Scores related to the DAS Model and the Maturity Scores calculated for items

<table>
<thead>
<tr>
<th>Maturity Score</th>
<th>Items</th>
<th>N</th>
<th>Stand. D.</th>
<th>Variance</th>
<th>Maturity Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>DLB 4.17 / Expert</td>
<td>1-1 can use any accounting software to perform the Accounting Processes. 2-1 know the general working principles and structure of Microsoft Office Software (Powerpoint, Excel, Word etc.). For example, I can enter data into Excel and create simple tables and graphs. 3-1 can interact, communicate, and collaborate with the Manager, Staff, Customer or Associated persons with the help of digital technologies. 4-1 can use integrated accounting software. (Domestic and Foreign ERP software such as NETSİS, LOGO, SAP, and Oracle) 5-1 know how to create logical functions in Excel, how to prepare graphics effectively and quickly, and details such as summary tables.</td>
<td>279</td>
<td>1.00</td>
<td>1.00</td>
<td>4.18</td>
</tr>
<tr>
<td>DLB 1.80/ Basic</td>
<td>6-1 can use sensor data to increase decision making. 7-1 have sufficient macro level Excel knowledge to use the Visual Basic (VB) programming language to solve things in the shortest way with algorithmic thinking logic. 8-1 can use machine learning based forecasting models to forecast revenues. 9-1 have knowledge of XBRL (Extensible Business Reporting Language) and Taxonomy concepts. I explain the effect on accounting and auditing. 10-1 can make suggestions for the application of Cloud Services in our organization and I can audit the cloud services.</td>
<td>279</td>
<td>1.523</td>
<td>2.232</td>
<td>2.98</td>
</tr>
<tr>
<td>DAV 2.58/ Intermediate</td>
<td>11-1 use any of the data visualization software. For example, IBM Watson Analytics, SAP Analytics Cloud, Tableau etc. 12-1 have knowledge regarding data management techniques. 13-1 can manage data protection and privacy policies. 14-1 can apply the necessary analysis methods to make analysis and estimation. 15-1 can choose the best visualization approach and solutions to present Data Analysis results. 16-1 can develop all data processing workflows and integrate them into the corporate workflow.</td>
<td>279</td>
<td>1.860</td>
<td>3.462</td>
<td>1.97</td>
</tr>
<tr>
<td>DSV 3.05/ Advance</td>
<td>17-1 know the digital technology trends affecting my profession. 18-1 understood how digital technologies will change accounting processes and business environments. 19-1 am researching educational programs about digital technologies.</td>
<td>279</td>
<td>1.272</td>
<td>1.619</td>
<td>3.21</td>
</tr>
<tr>
<td>PS 2.45/ Intermediate</td>
<td>20-1 can identify the main problems that arise when using digital technologies. 21-1 can suggest solutions for the problems that arise when using digital technologies. 22-1 can take measures to prevent technological problems.</td>
<td>279</td>
<td>1.492</td>
<td>2.229</td>
<td>2.35</td>
</tr>
</tbody>
</table>

Source: created by the authors.
This result, when evaluated together with other item maturity scores related to Digital Literacy Basic Level (DLB) ability and skills, indicated that accounting professionals have used accounting softwares, office programs and technology at the “expert” level when communicating with stakeholders. Results demonstrated in this research are in parallel with the results presented by Rai (2012) which concluded that the accounting professionals have attained the highest BT skills in terms of spreadsheets, e-mail programs and communication software, internet search tools, tax software and accounting softwares. The “Digital Literacy Advanced (DLA)”, which covers the skills and abilities related to advanced technologies, was found to be the ability and skills in which accounting professionals have the lowest maturity with a score of 1.80. The item that the participating accounting professionals scored the lowest was “I have knowledge about eXtensible Business Reporting Language (XBRL) and Taxonomy concepts. I can explain the effects of these on accounting and auditing)” with a score of 1.36. Results demonstrated in this research are in parallel with the results presented in the study conducted by Yıldırım & Sağlar (2014) on the applicability of XBRL in Turkey which set forth evidence confirming that the vast majority of the officials of the listed enterprises do not have knowledge about XBRL. It was further observed that the lack of knowledge on XBRL in these enterprises has not been corrected over time. Wulandari & Ali (2019) presented the insufficient knowledge of the academicians in Indonesia for their failure to integrate XBRL into the accounting curriculum and further as the reason for the resulting lack of knowledge on XBRL. The fact that this issue has not become widespread in Turkey can be put forward as the reason that accounting professionals have a low maturity in this regard. Other items further indicated that accounting professionals have a low level of maturity in data processing, Excel knowledge at the macro level and machine learning-based programs and there is a clear requirement in terms of abilities and skills in this regard. Wasserbacher & Spindler (2021) confirmed the prediction that the reason for not using machine learning in forward-looking forecasts is due to the restricted availability of talented professionals. The same study explained that the participants are aware of the technologies that affect their profession and have the maturity, strategy and vision required to develop them. The results obtained also supports the studies carried out by Bahador et al. (2018) and Aguiar et al. (2021).

Accounting professionals have obtained a maturity score of “2.58” and an “intermediate” level of maturity in the “Data Analysis and Data Visualization (DAV)” ability and skills which is another category of digital competencies. Predictive and prescriptive analytics have significance particularly when they provide insight into the decision-making processes of enterprises and add value to the organizational operations (Zhan, 2018). However, accounting professionals have a low maturity in using analysis methods for analysis and forecasting. They also have a low maturity with regard to data visualization softwares. As expressed in the study carried out by Perkhofer et al. (2019), the fact that accounting professionals focus only on Microsoft Excel as a visualization tool combined with a lack of knowledge and experience related to new types of visualization and interaction techniques (considering that the participants have an excel knowledge at the “expert” level with a maturity score of “3.90”) can be presented among the main obstacles in this subject. It is generally observed that accounting professionals have ability and skill deficiencies in data analysis and data visualization related
issues. One of the most important factors that will affect the acquisition of skills and abilities related to advanced technologies is that accounting professionals have the necessary strategy and vision in this regard. The results obtained provide strong evidence confirming that accounting professionals are aware of the technologies that affect their profession and that they know their potential impact on their profession. However, the research attempts of accounting professionals on training programs aimed at improving their skills and abilities is not at an adequate level. They do not have a developed ability to solve problems related to technology. Furthermore, they promote the studies stipulating the integration of advanced technologies like the use of Artificial Intelligence (AI) (Damerjia & Salimi, 2021), advanced level Excel knowledge, customer relationship management tools, business intelligence software and cloud-based technology knowledge (Heath, 2018; Leitner-Hanetseder et al., 2021), data strategy and planning, data analytics (CGMA, IMA, ACCA, IFAC) into the accounting curriculum. Considering that the acquisition of unstructured data has become the new norm (Knudsen, 2020), the need to develop low-level abilities and skills became apparent. Another result obtained is that accounting professionals are aware of the developing technology and have knowledge about how it will affect their business environment.

Table 8. Distribution of DAS Model Maturity Scores on the basis of Demographic Data

<table>
<thead>
<tr>
<th>Gender</th>
<th>Number of Persons</th>
<th>DAS</th>
<th>DLB</th>
<th>DLA</th>
<th>DAV</th>
<th>DSV</th>
<th>PS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>145</td>
<td>2.72</td>
<td>4.19</td>
<td>1.75</td>
<td>2.50</td>
<td>2.74</td>
<td>2.40</td>
</tr>
<tr>
<td>Male</td>
<td>134</td>
<td>2.89</td>
<td>4.15</td>
<td>1.85</td>
<td>2.68</td>
<td>3.27</td>
<td>2.50</td>
</tr>
<tr>
<td>Age</td>
<td>Number of Persons</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18-25</td>
<td>28</td>
<td>3.03</td>
<td>4.20</td>
<td>1.96</td>
<td>2.88</td>
<td>3.43</td>
<td>2.66</td>
</tr>
<tr>
<td>26-35</td>
<td>160</td>
<td>2.88</td>
<td>4.35</td>
<td>1.79</td>
<td>2.65</td>
<td>3.22</td>
<td>2.39</td>
</tr>
<tr>
<td>36-45</td>
<td>66</td>
<td>2.65</td>
<td>4.04</td>
<td>1.81</td>
<td>2.38</td>
<td>2.51</td>
<td>2.51</td>
</tr>
<tr>
<td>46-55 and above</td>
<td>25</td>
<td>2.46</td>
<td>4.02</td>
<td>1.51</td>
<td>2.34</td>
<td>2.23</td>
<td>2.21</td>
</tr>
<tr>
<td>Educational Status</td>
<td>Number of Persons</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High School-Associate Degree</td>
<td>19</td>
<td>2.64</td>
<td>4.02</td>
<td>1.55</td>
<td>2.17</td>
<td>3.22</td>
<td>2.24</td>
</tr>
<tr>
<td>Undergraduate Degree</td>
<td>195</td>
<td>2.88</td>
<td>4.12</td>
<td>1.72</td>
<td>2.69</td>
<td>3.42</td>
<td>2.45</td>
</tr>
<tr>
<td>Graduate Degree</td>
<td>65</td>
<td>2.96</td>
<td>4.18</td>
<td>1.83</td>
<td>2.76</td>
<td>3.46</td>
<td>2.56</td>
</tr>
<tr>
<td>Working Time</td>
<td>Number of Persons</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-5 Years</td>
<td>84</td>
<td>2.92</td>
<td>4.14</td>
<td>1.86</td>
<td>2.72</td>
<td>3.32</td>
<td>2.55</td>
</tr>
<tr>
<td>6-10 Years</td>
<td>85</td>
<td>2.80</td>
<td>4.22</td>
<td>1.74</td>
<td>2.34</td>
<td>3.25</td>
<td>2.46</td>
</tr>
<tr>
<td>11-15 Years</td>
<td>51</td>
<td>2.91</td>
<td>4.37</td>
<td>1.85</td>
<td>2.67</td>
<td>3.19</td>
<td>2.45</td>
</tr>
<tr>
<td>16-20 Years</td>
<td>37</td>
<td>2.80</td>
<td>4.29</td>
<td>1.79</td>
<td>2.57</td>
<td>3.18</td>
<td>2.15</td>
</tr>
<tr>
<td>20 Years and Above</td>
<td>21</td>
<td>2.62</td>
<td>4.09</td>
<td>1.56</td>
<td>2.42</td>
<td>2.90</td>
<td>2.13</td>
</tr>
</tbody>
</table>

Source: created by the authors.

As a result of the first question (RQ1) of the questionnaire presented within the scope of the study, the distribution of maturity scores on the basis of demographic variables was examined. Gender, educational level, experience, self-efficacy and socio-economic background were concluded to have an impact on the use of IT (Hinojo-Lucena et al., 2019). The analysis with regard to the maturity scores on the basis of gender in Table 8 demonstrates that the maturity score of male accounting professionals is 2.50 while the maturity score of female accounting professionals is 2.40. This situation reveals that maturity scores do not change based on gender of the accounting professionals. These results supported the evidence obtained by Maderick et al.
(2016) confirming that digital competencies and skills tend to be lower in the adult population compared to the young professionals. On the other hand, digital competencies and skills were found to increase based on educational background and seniority.

Evidence was obtained confirming the technologies such as the use of Robotic Process Automation (RPA) in routine accounting tasks and the collection of data with Internet-connected objects (e.g. Warehouse stock counting with Radio Frequency Identification technology). Bakarich & O’Brien (2021) concluded that both Robotic Process Automation (RPA) and Machine Learning (ML) are currently not widely used by public accountants or their clients. This result partially coincides with the result that we obtained from this study. Another conclusion derived from the implementation is that the prevalence of use of machine learning and artificial intelligence is limited, that is, at the basic level. These results coincide with the results obtained in the study conducted by Luo et al. (2018) and Leitner-Hanetseder et al. (2021) presenting the low rate of using artificial intelligence. Wasserbacher & Spindler (2021) confirmed the prediction that the reason for not using machine learning in forward-looking forecasts is due to the restricted availability of talented professionals. In the study entitled “Digitalization in Accounting”, KPMG (2017) obtained evidence confirming that big data analysis, data visualization and cloud computing tools are not widely used. Sestino et al. (2020) stated that although Big Data has business potential, its evolution is still at an early stage outside of engineering sciences. The results obtained partially support the conclusions of this study. The maturity score obtained from the item related to the XBRL reporting language is at a lower level. Another result obtained as a result of the implementation is that enterprises are aware of the technology and are constantly following it. In addition, companies allocate budgets for IT investments. However, the training support provided to personnel for learning new technologies is low compared to others.

**DISCUSSION**

This study is considered as the first step for the due diligence of the current digital competencies and skills of accounting professionals, tracking the development related to this issue and revealing the deficient aspects and requirements. As the second step, strong evidence is provided as to determine the level of technology used in the business environment, to meet the demands of employers’, the abilities and skills that will be required by accounting professionals and therefore the subjects that need to be integrated in the accounting curriculum by instructors. Unlike prior studies (Bahador et al. (2018), Aguiar et al. (2021), KPMG (2017)), this study also investigated the level of technology used in the business environments along with the ability and skill levels of accounting professionals. It is the study conducted by Wessels (2006) that motivates the research of the level of technology used in the business environment. Wessels (2006) researched for the existence of new and advanced technologies in the South African business environment, emphasized that these technologies did not play a significant role in the business environment and suggested that accounting professionals should acquire skills and abilities appropriate to the current business environment and thereupon made suggestions for the accounting curriculum. Although the need for the competencies investigated within the scope of this study is
a frequently enunciated and discussed topic over the last decade, it covers a period of about 60 years. Throughout the years when the computers were first introduced, accounting professionals did not consider the computers striking and they even hesitated to address the new competence needs until the 1970s (Doost, 1999). However, the need for competencies and skills is today seen as an obligation in the face of rapidly developing technology.

Evaluation with regard to the results obtained also supports the studies carried out by Bahador et al. (2018) and Aguiar et al. (2021). Furthermore the studies stipulating the integration of advanced technologies like the use of Artificial Intelligence (AI) (Damerjia & Salimi, 2021), advanced level Excel knowledge, customer relationship management tools, business intelligence software and cloud-based technology knowledge (Leitner-Hanetseder et al., 2021), ability to work and collaborate online on internal and external shared systems with cloud-based applications, online real-time reporting (Tsiligiris & Bowyer, 2021), data strategy and planning, data analytics (CGMA, IMA, ACCA, IFAC) into the accounting curriculum have been supported. Organizations also rely on non-transactional data to leverage customers' digital footprints, which moves the boundaries of accounting in information retrieval. Considering that the acquisition of unstructured data has become the new norm (Knudsen, 2020), the need to develop low-level skills and abilities related to data analysis and data visualization has become apparent. Another result obtained is that accounting professionals are aware of the developing technology that will probably affect their business environment. However, they do not want to receive training on these technologies.

The DAS mode analysis results revealed that the skills and abilities related to technologies that have not yet become widespread in the have not developed sufficiently. Accounting professionals were found to have a high level of maturity in core technologies. As accounting professionals have long used and/or trained to use core technologies such as ERP, spreadsheets and Business Intelligence (BI) (Tsiligiris & Bowyer, 2021), a high level of relevant skills and abilities was an expected outcome.

CONCLUSION
Identifying the competencies required for accounting professionals and maintaining their current status throughout the digital transformation process and in the future is essential in terms of people, realization of the combination of business processes and technology and meeting the requirements requested by employers.

Accounting professionals need to develop the skills related to applications such as artificial intelligence, machine learning, data analysis and data visualization to update themselves. However, it was concluded that they did not search for any training or course in order to acquire these skills. Professional organizations and employers are expected to assume a significant role in this regard. Professional organizations are required to publish clear frameworks concerning the abilities and skills for accounting professionals and support these skills and abilities by offering a range of trainings and courses. The results of the analysis revealed that employers have relatively low maturity in training their personnel in order to adapt to the new technologies they transferred. Employers are expected to assume a significant role in this regard. However, majority of the
employers avoid these roles due to costs and staff turnover. It should also be noted that there are various other digital barriers such as age, limited digital literacy, problems of access, infrastructure problems or distance which are also effective in the digital transformation of the existing staff. It was observed that applications such as artificial intelligence and machine learning are not yet widely used in business environments. The reason why these applications are not currently included in the processes was associated with high costs. Therefore, factors such as decreasing costs over time and facilitating transportation are thought to expand the use of technology. However, constantly developing technology with a dynamic structure constitutes the limitation of the study. Maturity models for developing the skills and abilities that accounting professionals will need in the future may be considered as the first step. Further comprehensive efforts aiming to prepare accounting professionals for the future such as the training of educators, the digital transformation of current accounting professionals, the integration of new courses into the curriculum, the preparation of course materials and the preparations for classroom practices will be needed in addition to the development of digital competencies. Companies’ switching to short-time or remote working due to the COVID-19 pandemic and difficulty in reaching people caused obstacles before the implementation of the study. The reluctance of people to participate in online applications and the difficulty of reaching companies constituted other limitations with regard to the implementation. The limitations for the models were tried to be eliminated by decreasing the high number of items in line with the extensive abilities and skills that are thought to complicate the implementation difficult. Another limitation of maturity models is the need to constantly update the identified abilities and skills in the light of developing technology or business environments.

Maturity models developed for the purposes of this study are presented in a flexible structure rather than a definitive framework. Models are open to further extensive testing in theoretical and practical environments aiming to keep them up to date and provide improvements. All reasonable efforts to ensure the conformity of the models were performed during the design and testing phases.

Finally, today's business environments have a dynamic structure. Fixed ideas (idée fixes) may reduce our chance of competition in the face of the flexible, adaptable and constantly improving structure of the technology that we are competing with. It should not be forgotten that it is the human resource rather than the system that makes digital business transformation possible. It is necessary to convince accounting professionals to attain the competencies required by the digital transformation environment and to lead them to practice.


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Institutional Review Board Statement:
The study was conducted according to the guidelines of the Declaration of Helsinki and approved by the ethics committee of the (Atatürk University), (approval number: 82/16.10.2020).

Informed Consent Statement:
Informed consent was obtained from all the participants involved in the study.

Data Availability Statement: The data presented in this study are available on request from the corresponding author. The data are not publicly available due to privacy issues.

Conflict of interests: The authors declare no conflict of interest.

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About the authors

Reşat KARCIOĞLU
Prof. Dr. Reşat Karcióğlu works at Atatürk University Business School in Erzurum.

Research interests: Cost Accounting, Financial Accounting, Accounting Education

ORCID ID: https://orcid.org/0000-0002-0903-3816

Fatih Ömür BİNİCİ
Asst. Prof. Fatih Ömür BİNİCİ works at Ağrı İbrahim Çeçen University in Ağrı.

Research interests: Cost Accounting, Financial Accounting, Accounting Education, Digital Transformation, Skill and Ability

ORCID ID: https://orcid.org/0000-0001-6147-1955

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Appendices

Appendix 1. Exploratory Factor Analysis

<table>
<thead>
<tr>
<th>DAS</th>
<th>Items</th>
<th>Factor Loads</th>
<th>Cronbach Alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>DAS</td>
<td>1-I can use any accounting software to perform the Accounting Processes.</td>
<td>0.711</td>
<td></td>
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<tr>
<td></td>
<td>2-I know the general working principles and structure of Microsoft Office Software (Powerpoint, Excel, Word etc.). For example, I can enter data into Excel and create simple tables and graphs.</td>
<td>0.777</td>
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<tr>
<td></td>
<td>3-I can interact, communicate, and collaborate with the Manager, Staff, Customer or Associated persons with the help of digital technologies.</td>
<td>0.815</td>
<td>0.895</td>
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<tr>
<td></td>
<td>4-I can use integrated accounting software. (Domestic and Foreign ERP software such as NETSİS, LOGO, SAP, and Oracle)</td>
<td>0.681</td>
<td></td>
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<tr>
<td></td>
<td>5-I know how to create logical functions in Excel, how to prepare graphics effectively and quickly, and details such as summary tables.</td>
<td>0.672</td>
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<td></td>
<td>6-I can use sensor data to increase decision making.</td>
<td>0.871</td>
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<tr>
<td></td>
<td>7-I have sufficient macro level Excel knowledge to use the Visual Basic (VB) programming language to solve things in the shortest way with algorithmic thinking logic.</td>
<td>0.694</td>
<td></td>
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<tr>
<td></td>
<td>8-I can use machine learning based forecasting models to forecast revenues.</td>
<td>0.641</td>
<td>0.822</td>
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<tr>
<td></td>
<td>9-I have knowledge of XBRL (Extensible Business Reporting Language) and Taxonomy concepts. I explain the effect on accounting and auditing.</td>
<td>0.600</td>
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<td></td>
<td>10-I can make suggestions for the application of Cloud Services in our organization and I can audit the cloud services.</td>
<td>0.458</td>
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<tr>
<td></td>
<td>11-I use any of the data visualization software. For example, IBM Watson Analytics, SAP Analytics Cloud, Tableau etc.</td>
<td>0.772</td>
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<td></td>
<td>12-I have knowledge regarding data management techniques.</td>
<td>0.770</td>
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<tr>
<td></td>
<td>13-I can manage data protection and privacy policies.</td>
<td>0.740</td>
<td></td>
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<tr>
<td></td>
<td>14-I can apply the necessary analysis methods to make analysis and estimation.</td>
<td>0.690</td>
<td>0.895</td>
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<tr>
<td></td>
<td>15-I can choose the best visualization approach and solutions to present Data Analysis results.</td>
<td>0.619</td>
<td></td>
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<tr>
<td></td>
<td>16-I can develop all data processing workflows and integrate them into the corporate workflow.</td>
<td>0.467</td>
<td></td>
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<tr>
<td></td>
<td>17-I know the digital technology trends affecting my profession.</td>
<td>0.826</td>
<td>0.851</td>
</tr>
<tr>
<td></td>
<td>18-I understood how digital technologies will change accounting processes and business environments.</td>
<td>0.762</td>
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<tr>
<td></td>
<td>19-I am researching educational programs about digital technologies.</td>
<td>0.643</td>
<td></td>
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<tr>
<td></td>
<td>20-I can identify the main problems that arise when using digital technologies.</td>
<td>0.844</td>
<td></td>
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<tr>
<td></td>
<td>21-I can suggest solutions for the problems that arise when using digital technologies.</td>
<td>0.750</td>
<td>0.890</td>
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<tr>
<td></td>
<td>22-I can take measures to prevent technological problems.</td>
<td>0.679</td>
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</table>