

Technological Knowledge, Soft Skills and E-Leadership Skills – three Pillars for the digitally competent Manager

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Abstract

Since recent studies reported that levels of digital competence among Europeans are still insufficient, this paper aims to clarify how digital competence can be conceptualized when applied in the management context. Based on the DigComp framework, a three-dimensional model with 19 areas of digital competence, encompassing technological knowledge, soft skills, and e-leadership skills, is proposed. This model is the result of a systematic literature review and content analysis of 61 frameworks of digital competence, soft skills, and e-leadership. From a theoretical perspective, the paper extends prior research on digital competence by focusing on the managerial context through integrating isolated areas such as soft skills and e-leadership. From a managerial perspective, the paper suggests a model that can help organizations create tools to assess and monitor current levels of manager's digital competence and to develop appropriate training programmes.

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1. Introduction

Today, our society is driven and permeated by digital technologies (Gray & Rumpe, 2017; Martin & Grudziecki, 2006). Technologies such as big data and machine learning, cloud and mobile computing, or wearable sensors have significantly altered and will continue to change the way we live and work (Cascio & Montealegre, 2016; Moreira, Ferreira, & Seruca, 2018; Schwarzmüller et al., 2018; White, 2012). That means the competencies to make use of these technologies and benefit from them have never been more essential. I refer to these competencies as “digital competencies”. In her project report from 2011, Kirsti-Ala Mutka already warned that people who lack digital competence risk to be excluded from important activities. For example, Iordache, Mariën, and Baelden (2017) stated that digital competence enables people to use new technologies to receive up-to-date information, and to exchange and develop knowledge with others.

Furthermore, digital competence has become a prerequisite for employees and managers. Guitert, Romeu, and Colas (2020) emphasized that digitally competent people would have better opportunities in finding jobs, while job seekers without knowing how to search for jobs online or filling out online applications would risk to stay unemployed. Schwarzmüller et al. (2018) pointed out that digital technologies have changed existing job profiles to the extent that nowadays almost every job requires “basic computer knowledge”. Quick decision-making, higher information density, greater insecurity, and enhanced availability have increased the complexity of employees and managers’ work. Especially the COVID-19 pandemic forced managers to increasingly use virtual collaboration tools in order to communicate with their employees and manage from distance. This requires “a new set of managerial abilities and a different potential of thinking and acting” (Gerasimenko & Razumova, 2020), which makes digital competence the centre of interest.

However, recent studies report that many Europeans do not have an adequate level of digital competence. For 2022, the Digital Economy and Society Index (DESI), which monitors Europe’s overall digital performance every year, acknowledged only 54% of Europeans having a basic level of digital competence. Likewise, a study by the European Commission (Curtarelli et al., 2017) pointed out that around one in seven employers (15 %) consider their staff for “not fully proficient when carrying out tasks using digital technologies at work”. Due to low levels of digital competence among owners, managers, and employees, companies cannot make use of advanced digital technologies, which results in productivity losses, increasing labour costs, and slower reaction time to change.

Why do organizations still struggle in developing staff that possesses a professional level of digital competence? A reason could be that employers equate digital competence with technical knowledge, and therefore consider it sufficient for their managers to have technical capacity. There is a great confusion among the term “digital competence” as no appropriate and commonly accepted definition exists (Ilomäki et al., 2016). What complicates this issue is that a plethora of terminology surrounding “digital competence” is available, such as “computer literacy”, “digital literacy”, “digital skills”, or “information literacy”. In a literature review on digital competence, Gallardo-Echenique et al. (2015) found 15 terms close to digital competence, with “digital literacy” being the one that is most often used as synonym. Whereas some authors clearly distinguish digital competence and digital literacy (Martin & Grudziecki, 2006, Süße et al., 2018), others regard them as conceptually equivalent and use them in the same paper (Cartelli, 2010; Li & Ranieri, 2010; Ferrari, 2012). This is not only puzzling for academics who want to study digital competencies, but also for managers, as a lack of comprehension will decelerate the installation of digital competencies in organizations. Of course, researchers have developed several models to measure digital competence. One of the most prominent

ones, especially in Europe, is the Digital Competence Framework for European Citizens (DigComp). Its universal and all-encompassing characteristic makes it applicable in various contexts and many authors regard it as solid base for studying digital competences (Findeisen & Wild, 2022; Khan, 2019; Reisoğlu & Çebi, 2020; Romero-Tena et al., 2020). Nevertheless, it is aimed at European citizens, so it needs some adjustments when being applied in the context of management and organization.

From an academic perspective, digital competence in the management literature or, in the context of work in general, is scarce. In their paper “Digital competence of the workforce - a research topic?”, Murawski and Bick (2017) first conducted a literature review on digital competence, before they searched manually within a range of IS, HR and scientific learning journals, but no articles discussed digital competence in the context of work. Similarly, Oberländer, Beinicke, and Bipp (2020) found only a few papers in their literature review on digital competence for the workplace. However, closer examination of these papers revealed that only the sample included workers, while the target group comprised non-working people. As regards the target group, most research papers on digital competence either focus on students (Calvani et al., 2008; Cartelli, 2010; Hatlevik, Ottestad, & Throndsen, 2015; Li & Ranieri, 2010) or teachers (Krumsvik, 2008; Pettersson, 2017; Reisoğlu, & Çebi, 2020; Romero-Tena et al., 2020). There appears to be a particular dearth of in-depth studies of digital competencies in the management literature.

The aim of this paper is therefore to enhance the understanding of digital competence, specifically in the management literature, by developing a digital competence model that can be applied in the management context. This model, which is based on the DigComp framework, regards digital competence as a set of technological knowledge, soft skills and e-leadership skills that enable managers to successfully complete their job tasks in a virtual work environment. I argue that technological knowledge is the base for each model of digital competence, since nowadays, each manager must have knowledge of digital technologies, but this alone is not sufficient. For competent performance at work, managers require also soft skills that help them to deal with challenges that they encounter on a daily base. The importance of soft skills for employability, especially in a post-COVID-19 era, is highly recommended, but current frameworks of digital competence have failed to consider this (Anton-Sancho, Vergara, & Fernandez-Arias, 2021; Blanka, Krumay, & Rueckel, 2022; Fernández-Arias et al., 2021; Segura Rondan et al., 2022). Finally, due to their position, it is also essential that managers lead the people and organizations in the changes underway, thus e-leadership skills are the third important element of digital competence. So far, e-leadership skills have not been considered at all in frameworks of digital competence, but researchers have argued that in order to succeed in a virtual work environment, today’s leaders must adopt new leadership skills (Liu et al., 2018; Contreras, Baykal, & Abid, 2020)

To develop this model, I conducted a systematic literature review in the databases Web of Science, Scopus, and Google Scholar. This resulted in a final sample of 61 articles on digital competence, soft skills, and e-leadership, which were analysed by means of inductive content analysis. The digital competence model encompasses 19 building blocks or areas, grouped under the three dimensions “technological knowledge”, “soft skills”, and “e-leadership skills”.

With this conceptualization, the paper contributes to research that regards digital competence as consisting of digital and non-digital skills (e.g. González Vázquez, 2019; Neumeyer & Liu, 2021; Peiró & Martínez-Tur, 2022). Moreover, by developing a digital competence model for managers, the paper addresses calls for studies to close the research gap of digital competence in the management literature which is still prevalent today (Oberländer & Bipp, 2022).

The organization of the paper is as follows. The next section presents the theoretical backgrounds of digital competence and the DigComp framework, as well as of soft skills and e-leadership. Then, the research methodology describing the literature selection criteria and analysis of the papers is illustrated, followed by a presentation and discussion of the digital competence model. Afterwards, theoretical and practical implications are given, before concluding the paper.

2. Theoretical Background

2.1 Digital Competence and the DigComp Framework

The first time that the term “digital competence” came up in research was in the year 1998. In his short article “Computed and Digital Radiography”, John Strauss described the process and the effects of how digital imaging systems transform general radiography. In this technological and medical context, he also mentioned “digital competencies”, but presented no definition of the term. The first definition of digital competence appeared 2004 in a conference paper with the title “Personality Theory and Human Factors Research”. The author, Mark E. Koltko-Rivera, described digital competence as “competence in working within a highly computerized environment” (Koltko-Rivera, 2004). In 2006, the European Commission formulated digital competence as one of eight key competences that citizens required for lifelong learning. This report is regarded as one of the forerunners in digital competence research (e.g. Cartelli, 2010; Godhe, 2019; Ilomäki et al., 2016), and paved the way for the increasing interest in this concept, which, according to Spante et al. (2018), started around 2010. According to Ilomäki et al. (2016), digital competence is a “strongly political term” that is only seldom used in research, and most studies on digital competence are related to the education sector, focusing on students and teachers (Periáñez-Cañadillas, I., Charterina, J., & Pando-García, 2019). However, the term “digital competence” is not well defined and many authors criticize that the concept refers to general skills and knowledge of citizens without a specific context (Krumsvik, 2014; Pettersson, 2017). These definitions have in common that they differentiate competence from knowledge and skills by regarding competence as overarching concept that combines knowledge, skills, and behaviours, which is also the approach used in this paper.

In order to identify the major components of digital competence, the DigComp project has been launched in 2010 by the Joint Research Centre on behalf of the Directorate General for Education and Culture. The outcome of this project should be a reference framework to understand and develop digital competence in Europe. In the first project report from 2012, Ferrari analysed fifteen frameworks on digital competence and developed an encompassing definition of the term:

Digital Competence is the set of knowledge, skills and attitudes [...] that are required when using ICT and digital media to perform tasks, solve problems, communicate, manage information, collaborate, create and share content and build knowledge effectively, efficiently, appropriately, critically, creatively, autonomously, flexibly, ethically, reflectively for work, leisure, participation, learning, socializing, consuming and empowerment. (Ferrari, 2012)

In the final report that was published in 2013, Ferrari identified 21 digital competences with three proficiency levels (foundation, intermediate, advanced) and classified them into five areas: information, communication, content-creation, safety and problem-solving. For each competence, the author provided examples of knowledge, skills, and attitudes, as well as examples of how the competence can be applied for specific purposes.

In 2016, the concepts and vocabulary of “The European Digital Competence Framework for Citizens” (Vuorikari et al., 2016), or just DigComp framework, were updated. For example, the first area of digital competence, “information”, has been redefined as “information and data literacy”. Like the competence areas, the descriptions of the competences themselves got changed. For instance, the competence “browsing, searching and filtering information” in the first area was updated to “browsing, searching and filtering data, information and digital content. The authors labelled this updated version of the DigComp framework as “DigComp 2.0”. Whereas the terminology of the framework changed, the numbers of competences and competence areas remained the same.

Another update of the DigComp framework was published in 2017 as “DigComp 2.1”. This version expanded the proficiency levels from three to eight and provided examples of use for each level. Besides the original levels “foundation”, “intermediate”, and “advanced”, another level called “highly specialized” was added. Each of these four levels is further divided into two sub-levels.

The latest version of the DigComp framework came out in 2022 as “DigComp 2.2”, and focused on examples of knowledge, skills and attitudes applicable to each competence. For each of the 21 competences, the authors provided 10-15 statements related to knowledge, skills, attitudes as well as scenarios for employment and learning.

The DigComp framework addresses stakeholders such as policy makers, schools, universities, and training institutions. European countries use DigComp in different ways, for example for the professional development of teachers (e.g. Croatia, Lithuania, Norway, Portugal), as assessment tool to test and certify the digital competence of people (e.g. Belgium, Estonia, France, Poland), or to support strategic planning and policy-making (e.g. Germany, Italy, Malta, Spain). The framework further became a reference model for other digital competence initiatives, like the European Framework for Digitally-Competent Educational Organisations (DigCompOrg) (Kampylis, Punie, & Devine, 2015), the Digital Competence Framework for Consumers (DigCompConsumers) (Brečko et al., 2016), and the European Framework for the Digital Competence of Educators (DigCompEdu) (Redecker, 2017).

2.2 Technological Knowledge, Soft Skills, E-Leadership

According to Ala-Mutka (2011), knowledge is “the body of facts, principles, theories and practices that is related to a field of work or study”. Knowledge encompasses but is not limited to formal knowledge acquired through academic institutions as well as practical knowledge acquired through less formal means and exposure to various life experiences while working or participating in simulated environments (Jennings, 2020). Rauner (2007) argues that practical knowledge is gradually acquired through experience within a job role and integrates with theoretical knowledge, resulting in the person to complete new and non-structured tasks. In this regard, it is important to take into account how knowledge and experience are acquired, so the significance of context to provide meaningful learning where knowledge can be connected to real-life experiences.

Knowledge relating to products, technologies, and/or processes is referred to as technological knowledge. Few would contest the idea that technological knowledge is a key factor in business performance. Numerous studies in industrial organization economics and strategic management have found the anticipated positive correlation between technological knowledge and measures of sales or profitability (Moorthy & Polley, 2010). When relating to digital competence, technological knowledge has been identified as significant component in the definitions (Gerasimenko &

Razumova, 2020; Ilomäki et al., 2016; Janssen et al., 2013; Soldatova & Rasskazova, 2014). It is the “information, awareness, and understanding that users have of the existence and usage of different digital tools” (Iordache, Mariën, & Baelden, 2017). Even though technology is one of the main characteristics of digital competence, it does not imply that managers need to be tech-savvy. For Contreras, Baykal, and Abid (2020), managers should be aware of the most relevant technologies, but it is sufficient to know how to benefit from and lead efficiently through technologies. In this regard, Van Wart et al. (2017) add that managers must be able to choose the right tools and technologies depending on the context. This also depends whether the technology is used just for the manager himself or for the whole team. Therefore, technological knowledge is important and therefore forms the first dimension of the digital competence model for managers. However, there are other skills necessary for being digitally competent. Management is a task that requires soft skills, and most employers consider soft skills such as team building, communication skills and delegation to be far more important than the technical ability of their managers.

To put it simply, the skills of each individual can be classified into hard skills and soft skills. Hard skills include basically technical skills that help people to handle job-specific tasks, such as knowing how to operate a machine or how to use specialized software (Anton-Sancho, Vergara, & Fernandez-Arias (2021). They are usually learnt through courses and vocational training, and can be demonstrated through educational certificates. On the other hand, soft skills are the “set of socio-emotional capacities and skills that people use in their interaction with others, which are key to achieving personal and work success” (Segura Rondan et al., 2022). Different to hard skills, they are shaped by the individual’s personality, in interactions with other people, and through the social environment (family, friends, culture). Furthermore, they are not specific to a particular job, but are applicable to any profession, which is why they are also called “transversal skills” (Fernández-Arias et al., 2021). There are several examples of soft skills and ways to classify them. For example, Succi and Canovi (2020) list entrepreneurial skills, coping skills, learning to learn, working in teams, effective communication, adaptability, problem solving, conflict management, and endurance under soft skills. Levasseur (2013) divides soft skills into personal skills, interpersonal skills, group skills, and organizational skills. Bartel (2018) differentiates soft skills that relate to the individual’s personality, such as communication, working in teams, motivation, or leadership, and soft skills that refer to the intellectual area of the individual, such as critical thinking, analytical reasoning, or problem solving.

Historically, hard skills have been regarded as more relevant for people, not only in industry, but also in academia. Succi and Canovi (2020) criticise that the majority of research has focused on hard skills and only little attention has been given to the importance of soft skills. This might be in the association that we have when thinking about the adjectives hard and soft. While “hard” implies terms like *objective*, *clearly defined*, and *reliable*, “soft”, as the opposite, must imply *subjective*, *fuzzy*, and *unreliable* (Claxton, Costa, & Kallick, 2016). Consequently, hard skills are considered as a must-have, while soft skills are perceived as nice to have. This perspective has changed in the last years. Especially the transformation of jobs in the light of digitalization has led to a high demand of soft skills in the labour market (Centeno et al., 2019). Nowadays, soft skills are a significant factor for employability (Bartel, 2018; Gruzdev et al., 2018), since they positively affect employee performance (Berenstein et al., 2020) and condition professional success (Fernández-Arias et al., 2021). People with soft skills have better chances to find and keep jobs as well as advance in their careers (Succi & Canovi, 2020). Marrero et al. (2018) indicated that soft skills allow people to achieve effective interaction and adequate performance at work and in the social sphere. Their transversal characteristic makes soft skills more transferable and adaptable in today’s fast-paced environment (Bak, Jordan, &

Midgley, 2018). Many employers consider them even more important than hard skills, because they “make a major difference in someone’s contribution to the organization” (Cassidy, 2021). They are indispensable for healthy and committed teams and thus for sustainable corporate success, especially among managers. In other words, soft skills are particularly important in times of home office and remote work. Managing teams from a distance is far more complex than on site. Employees often suffer from a lack of personal contact, and working from home increases the risk of burnout for many. Therefore, managers must engage in supportive management practices such as trust building, open communication, motivation, and information sharing (Wang et al., 2021) that all require soft skills. Overall, there is an increase in the number of studies that regard soft skills as essential part of managers skillset in a post-COVID-19 era (Anton-Sancho, Vergara, & Fernandez-Arias, 2021; Blanka, Krumay, & Rueckel, 2022; Cedefop, 2021; Fernández-Arias et al., 2021; Segura Rondan et al., 2022), which is why there are considered as second dimension of the digital competence model for managers.

Finally, e-leadership skills are the third dimension of the digital competence model. In the broadest sense, terms such as “e-leadership”, “virtual leadership”, or “digital leadership” are based on a spatial and temporal separation of leaders and teams, so that the leader has to use information and communication technologies to exercise leadership.

The term e-leadership started to become popular around the early 2000s (Torre & Sarti, 2020). One of the first and most often cited definition of e-leadership is the one by Avolio, Kahai, and Dodge (2000), who defined e-leadership as “a social influence process mediated by AITs [Advanced Information Technologies] to produce a change in attitudes, feelings, thinking, behavior, and performance with individuals, groups, and/or organizations”. Later, the authors modified their definition to emphasize the importance of the context in which this social influence process takes place. Accordingly, in their new definition, e-leadership is a “social influence process embedded in both proximal and distal contexts mediated by AITs that produce a change in attitudes, feelings, thinking, behavior, and performance” (Avolio et al., 2014). A more comprehensive definition of e-leadership is from Roman et al. (2019): “E-leadership is a set of technology-mediated social influencing processes intended to change attitudes, feelings, thinking, behavior, and performance, which are based on ability to communicate clearly and appropriately, provide adequate social interaction, inspire and manage change, build and hold teams accountable, demonstrate technological know-how related to ICTs, and develop a sense of trust in virtual environments”. The purpose of e-leaders is to exploit digital technologies to achieve organizational efficiency and create a ubiquitous digital environment. In order to accomplish that, traditional leadership practices cannot be simply transferred to the e-leadership setting (Contreras, Baykal, & Abid, 2020). For example, when leading virtually via tools such as Microsoft Teams, communication skills as in traditional face-to-face communication may not be sufficient for effective performance management, employee development and trust building (Dirani et al., 2021; Wang et al., 2021). Leadership in a virtual environment may require new and different skills than traditional face-to-face leadership. In their review paper about leadership in a digitalized world, Cortellazzo, Bruni, and Zampieri (2019) identified inspiring and motivating employees, creating a positive organizational environment for collaboration and unity, making rapid decisions, solving problems, identifying the need for change, and exploring and creating networks to lobby for resources and stakeholder support as critical skills for e-leaders. A prominent model that shows relevant competencies for effective e-leadership is the Six E-Competency (SEC) model by Van Wart et al. (2019). The authors identified e-communication, e-social, e-team building, e-change management, e-technological and e-trustworthiness as major elements of competent e-

leadership. For example, e-communication is clear and organized communication via electronic tools that avoids errors and miscommunication.

What has been a subject for criticism in the literature on e-leadership is that definitions of the concept focus mostly on the digital aspect and tend to oversee the non-digital, implying that the traditional leadership skills are no longer relevant in a virtual environment (Jameson et al., 2022). Scholars therefore claim e-leaders must combine both digital and traditional working methods. As pointed out by Van Wart et al. (2019), e-leadership is the “effective use and blending of electronic and traditional methods of communication”. However, for the purpose of this paper, e-leadership skills are understood as being more directed towards digital technologies, allowing a separation of skills into digital (e-leadership skills) and non-digital ones (soft skills). Thus, the digital competence model consists of the three dimensions technological knowledge, soft skills, and e-leadership skills. In other words, managers require technological knowledge, soft skills and e-leadership skills for being digitally competent. What specific areas this three dimensions cover was the objective of the systematic literature review presented in the next section.

3. Methodology

To find frameworks of digital competence as well as papers about soft skills and e-leadership, I performed a systematic literature review of relevant publications within the management and organization field. Systematic literature reviews create the base for new and advanced knowledge, facilitate the development of novel theory, provide answers to questions in mature research areas and identify new areas of research (Webster & Watson, 2002). The search was carried out in the databases Web of Science, Scopus, and Google Scholar. In conducting the systematic search for papers, I used the search string ‘digital competenc* OR ‘digital skills’ AND ‘digcomp’. Furthermore, I coupled the term ‘digital competenc*’ through the Boolean operator AND respectively with the keywords ‘soft skills’ or ‘e-leadership’. Since technological knowledge is considered as a main element in most frameworks of digital competence, it had been left out in the search string. As regards the publication period, I set an interval from 2000 to 2022. To increase the reliability of the findings, the search for key words was run twice. This resulted in an overall amount of 316 potentially relevant papers. In a first screening process, the title and abstract of each article were checked, which led to an exclusion of 171 papers. The remaining 145 articles were analysed based on the following criteria:

- 1) discussing digital competence in the field of management and organization, IT, or education. Other disciplines such as mathematics or arts and humanities were not considered (N=22)
- 2) be published in peer-reviewed academic journals or conference papers. Other publication types such as book chapters or newspaper articles were excluded (N=14)
- 3) be written in good English, and considering the guidelines and structure of academic papers. Thus, papers in simple English, bad syntax, unclear structure or wrong citations were excluded (N=29)
- 4) providing original frameworks of digital competence at the individual level, as well as frameworks of soft skills and e-leadership skills. Consequently, articles that used frameworks from previous studies or that dealt with digital competence at the firm level were not considered (N=28)

The adoption of the selection criteria resulted in a final sample of 52 articles. Since the objective of the paper is to develop a digital competence model for managers based on the DigComp framework,

I manually added all four versions of the DigComp framework as well as five reports in which the DigComp framework was applied. Fig. 1 summarises and illustrates the systematic review flow used to finalise the dataset of 61 studies.

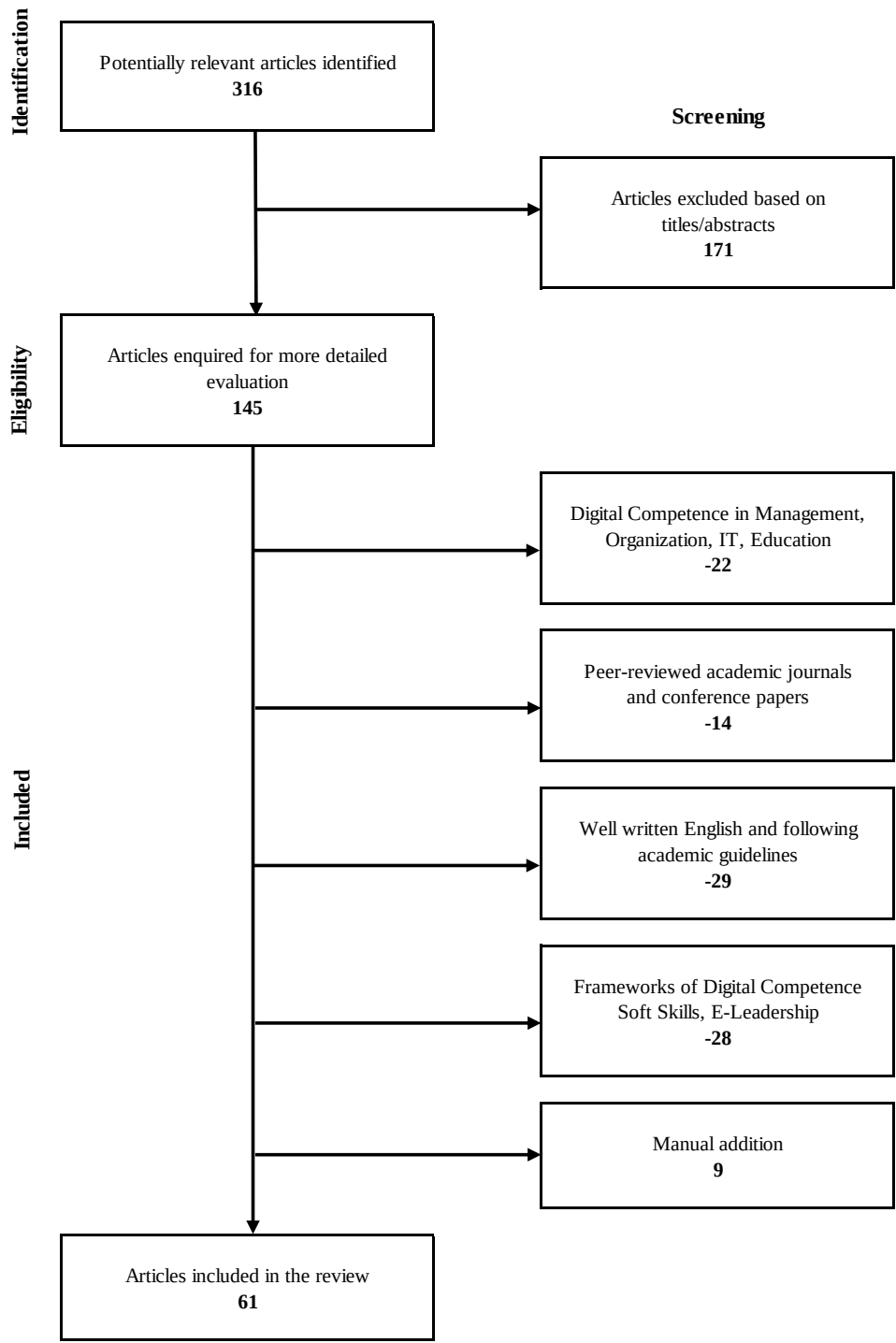


Figure 1: Overview of the Systematic Literature Review

In the next step, I read all papers several times and extracted the statements and descriptions of competencies or skills into an excel sheet. The objective was to find skills or competencies that can be sorted under ‘Technological Knowledge’, ‘Soft Skills’, and ‘E-Leadership Skills’, since these should be the pillars of the digital competence model. To achieve this, I analysed the data by means of inductive qualitative content analysis. This approach seemed particularly suitable for the purpose of my study, because it is recommended when former research about the phenomenon under investigation is scarce or fragmented (Vaismoradi, Turunen, & Bondas, 2013), as in the case of digital competence in the field of management. Furthermore, content analysis is used to categorize data (Schutz, 1958), so it supports the objective of the study mentioned above. The aim of the qualitative content analysis is to produce understanding of the meaning of the content that is analysed. This is done by conceptualising the research data and classifying them into meaningful and relevant categories (Singh, Hu, & Roehl, 2007). Researchers use codes to label the data, compare, group, and sub-divide the codes into (content) categories. A category is a broad idea or concept in which a number of specific codes have been grouped (Vears & Gillam, 2022). The inductive approach implies that all codes are developed during the coding process and do not stem from previously formulated coding lists.

During the analysis, all competence statements were initially coded and individually sorted into clusters according to similarity of meaning. Each cluster was named and compared for further analysis, which involved replacing of statements into different groups or renaming groups. Figure 2 provides an illustration of the initial coding process, suggesting that statements 50, 53, 57, and 58 should be put into one group, since they all included aspects of communication.

47	to adapt to different cultural contexts	ADAPT
48	the capacity to deal with a problem in a creative way	PROBL
49	to inspire and motivate employees	MOTIV
50	to listen effectively without visual cues and focus on the content of the message	COMM
51	to be able to support others with their digital competence development.	SUPPOR
52	to seek opportunities for self-development	SELF-D
53	to adapt communication strategies to the specific audience	COMM
54	to identify technical problems when operating devices and using digital environments	PROBL
55	to actively and constantly explore emerging technologies	OPENM
56	to select, interpret and evaluate information	INFORM
57	to use the most common communication tools when communicating	COMM
58	to interact with friends, coworkers, students, and family via digital tools	COMM
59	to use innovative digital tools to modify existing elements in order to improve them	INNOV
60	to develop autonomy and self-efficacy	SELF-D
61	to appreciate and recognize individual performance	MOTIV

Figure 2. Extract of the initial coding process of competence statements

The analysis resulted in an initial model consisting of 21 areas or building blocks of digital competence. For each building block, I formulated five to six descriptions to provide understanding of its meaning. For example, one description of the building block ‘Knowledge about Hardware and Software’ was ‘to understand the basic ICT concepts of hardware and software’. To validate the results, I presented the preliminary model to other researchers in meetings and seminars to obtain feedback and suggestions. The articulation of the final model went through a number of iterations, where integrations and modifications were made. Following these validations, the amount of building blocks and descriptions was reduced, and the names of some building blocks were re-formulated,

resulting in a digital competence model of 19 building blocks with four to five descriptions. This model will be presented in the next section of the paper.

4. Findings

The content analysis of the skills and competence statements resulted into 19 building blocks of digital competence for managers. These building blocks were grouped under the three dimensions ‘Technological Knowledge’, ‘Soft Skills’, and ‘E-Leadership Skills’. The outcome of this process was the digital competence model as shown in Table 1.

Digital Competence		
Technological Knowledge	Soft Skills	E-Leadership Skills
• Knowledge about Hardware and Software • Knowledge about Information Management • Knowledge about Digital Content • Advanced Technological Knowledge	• Self-Assessment & Self-Development • Open Mindset • Responsibility • Creativity and Innovation • Problem Solving • Face-to-Face Communication • Conflict Management	• Technical Skills • Digital Communication • Change Management • Self-Leadership • Helping and Motivating Others • Team Working • Trust-Building • Time Management

Table 1: The final Model of Digital Competence for Managers

In the following, each of the three dimensions and the building blocks are presented in more detail. The first dimension is named ‘Technological Knowledge’. In this paper, technological knowledge is defined as the manager’s understanding of the function and operation of digital technologies. That means for example knowing how to install software on a computer, or knowing where to find information online. Four areas of technological knowledge were identified: 1) Knowledge about Hardware & Software, 2) Knowledge about Information Management, 3) Knowledge about Digital Content, and 4) Advanced Technological Knowledge. Whereas knowledge of the first three areas covers basic technological understandings, the fourth area includes more specialized knowledge, which is more and more required for managers nowadays. Table 2 illustrates the dimension ‘Technological Knowledge’ which its building blocks and descriptions.

TECHNOLOGICAL KNOWLEDGE	
Knowledge about Hardware & Software	To understand the basic ICT concepts of hardware and software To be able to operate the fundamental software needed for work To understand the most common digital tools and applications used at work To select appropriate digital resources for working To protect devices and digital systems against external threats
Knowledge about Information Management	To search for digital information in databases and search engines To select information using straightforward criteria To analyze and interpret digital data and information in a systematic manner To critically examine digital information and determine which information is relevant To usefully organize, maintain, and retrieve digital data in a structured manner
Knowledge about Digital Content	To create textual, numerical, and/or audiovisual information and content using the most common tools To edit digital content To be aware of author rights and different forms of digital content diffusion To be able to protect one's own digital identity To know how to protect personal data that could be compromised in digital environments
Advanced Technological Knowledge	To modify applications that are relevant for work To be able to program in at least one programming language To recognize and address technical issues when using digital technologies To tailor digital environments to individual needs To know how to set up online work platforms to support remote work

Table 2: Dimension ‘Technological Knowledge’

The second dimension of the digital competence model covers ‘Soft Skills’. I defined soft skills as transversal skills that help managers to adapt and behave positively, so that they can deal effectively with the challenges of their professional and everyday life. Insofar, soft skills are not necessarily related to a technology nor do they focus solely on the manager’s work. Overall, seven types of soft skills were included in the model: 1) Self-Assessment and Self-Development, 2) Open Mindset, 3) Responsibility, 4) Creativity and Innovation, 5) Problem Solving, 6) Face-to-Face Communication, and 7) Conflict Management. The ‘Soft Skill’ dimension is presented in Table 3.

SOFT SKILLS	
Self-Assessment & Self-Development	To recognise where one's own competencies needs to be improved or updated
	To use online resources or social media to learn about new trends and technologies
	To actively search for opportunities for training and development
	To continuously expand and enhance one's repertoire of digital and business knowledge
Open Mindset	To develop self-efficacy when dealing with goals, tasks, and challenges
	To be ready to learn new things about one's work and technological trends
	To be patient to try new digital applications, pursue goals perseveringly and be ready to make an effort
	To experiment with new management practices and digital tools
Responsibility	To consider the consequences of one's actions in real-life and in a digital context
	To act responsibly in dealing with others and with private and corporate data
	To have due regard to reliability and privacy
	To understand the role of digital technologies for social well-being and social inclusion
Creativity and Innovation	To use digital technologies to create new knowledge for the organization
	To incorporate innovative technologies when completing tasks at work
	To employ strategies to deal with the dynamic digital environment
	To creatively address issues and opportunities
Problem Solving	To recognise issues, analyse them, and provide a rational assessment
	To take advantage of digital tools when addressing an issue and searching for a solution
	To investigate what causes the problem to understand the situation
	To interact with digitally available resources to acquire meaningful knowledge
Face-to-Face Communication	To strive for strict communication transparency and clarity to avoid misunderstanding
	To pay attention to the message's content while listening effectively without visual cues
	To offer timely, insightful feedback and actively engage colleagues and subordinates
	To separate important from unimportant information and summarize all information
Conflict Management	To be mindful of behavioural norms and cultural and generational diversity
	To understand how personality and conflict management style are related
	To discuss problems with others and assess various viewpoints to find solutions that satisfy everyone
	To be open to shifting priorities in order to find a solution
	To make an effort to reach a compromise in disputes
	To gather as much information as possible and maintain open communication

Table 3: Dimension 'Soft Skills'

The third and last dimension that is important for digitally competent managers is 'E-Leadership Skills'. Under e-leadership, I understood the skills of managers to lead people and organizations in the changes brought on by digitalization. It was not always clear to separate soft skills from e-leadership skills, as there was some overlapping of areas such as motivation or communication. As for this model, e-leadership skills are closer related to the organizational context of the manager's work than soft skills and have a stronger connection with digital technologies. The analysis revealed eight e-leadership skills that were particularly important for digital competence: 1) Technical Skills, 2) Digital Communication, 3) Change Management, 4) Self-Leadership, 5) Helping and Motivating

Others, 6) Team Working, 7) Trust-Building, and 8) Time Management. A detailed description of this dimension is visualized in Table 3.

E-LEADERSHIP SKILLS	
Technical Skills	- To combine a variety of digital tools to overcome communication barriers with stakeholders - To be able to drive organizational progress and digital transformation of processes - To understand the opportunities that digital technologies offer for the organization - To optimize the use of digital technologies from a cost-benefit perspective
Digital Communication	- To interact with internal and external stakeholders by using the most common communication tools - To apply appropriate language and basic strategies for organizational communication via digital media - To use digital tools and social media to network and collaborate both inside and outside the organization - To share and exchange information and experiences with colleagues and subordinates via digital tools
Change Management	- To organize, track, and improve the use of digital technologies at work - To take into account the generational differences of employees when it comes to technology adoption - To persuade employees to welcome change and support innovation - To strike a balance between old and new technologies and anticipate potential conflicts
Self-Leadership	- To be aware of one's identity, emotions, motivations, strengths, and weaknesses - To exert personal self-control over feelings, thoughts, and actions in order to achieve goals - To take responsibility for one's own decisions, feelings, and actions - To recognize others' feelings and emotions and respond to them appropriately - To maintain motivation to finish tasks and persevere through challenges
Helping and Motivating Others	- To recognize areas where the skills of others need to be strengthened and assist them in developing skills - To acknowledge and value each person's performance - To foster a sense of community and healthy relationships among employees - To encourage cross-border communication, idea sharing, and opportunity creation - To give virtual teams autonomy and to bring them together around a common objective
Team Working	- To know a variety of relevant people inside and outside of one's organization who can be contacted - To collaborate in social and professional networks using the most popular tools - To share digital content and information by choosing the most suitable digital technologies - To be open to team suggestions for improvements - To recognize that teamwork necessitates skillfully managing and negotiating the group dynamics
Trust Building	- To give followers freedom and respect them as individuals - To make clear expectations known and keep their promises - To keep a work-life balance despite having constant access to technology - To build an engaging, effective, and relevant digital learning environment - To value and accept the perspectives of people from various backgrounds and cultures
Time Management	- To establish precise, measurable, achievable, and pertinent objectives - To plan and organize all activities and decide on a time to complete specific tasks - To prioritize tasks in order to determine which ones require more attention than others - To assign certain tasks to others in order to free up time to concentrate on higher value activities - To establish firm boundaries that promote work-life balance and actively take time for own wellbeing

Table 4: Dimension 'E-Leadership Skills'

As already stated in the introduction, digital competence is as a set of technological knowledge, soft skills and e-leadership skills that enable managers to successfully complete their job tasks in a virtual work environment. The model outlines 19 competence areas that are grouped under the three dimensions. For being digitally competent, managers must possess a combination of technological knowledge (e.g. knowledge about hardware and software), soft skills (e.g. problem solving and conflict management), and e-leadership skills (e.g. self-leadership). That means soft skills alone or technological knowledge and e-leadership skills are not sufficient for successful job completion.

5. Discussion

In response to the call for clarification of the concept of digital competence in the context of management, I proposed a framework by combining isolated areas such as soft skills and e-leadership with digital competence. This implies that managers need technological knowledge, soft skills and e-leadership skills for being digitally competent.

Research on competences of individual people is often based on the concept of Knowledge, Skills, and Attitudes (KSAs). Likewise, authors in the field of digital competence regard it as combination of skills, knowledge, and attitudes (Ferrari, 2012; Janssen et al., 2013; Vieru et al., 2015). KSAs are the input factors that an individual requires to perform a certain task. Whereas knowledge is regarded as the facts, information, principles, or theories that a person has in a specific field, skills are considered as the ability to apply this knowledge to perform a certain task (Ferrari, 2013; Oberländer, Beinicke, & Bipp, 2020; Vieru et al., 2015). Attitudes, on the other hand, are the “ways of thinking” (Vieru et al., 2015) or “motivators of performance” (Ferrari, 2013). KSAs were also considered when developing the digital competence model. While knowledge is represented in the first dimension ‘Technological Knowledge’ and skills are expressed as ‘Soft Skills’ and ‘E-Leadership Skills’, attitudes were more difficult to integrate, but can still be found in some descriptions. For example, “acting responsibly in dealing with others” in the description of the soft skill “responsibility”, or “acknowledge and value each person’s performance” in the description of the e-leadership skill “helping and motivating others” are attitudes, since they show how a person is dealing with things emotionally. Researchers often visualize KSAs in form of an iceberg model, with knowledge and skills representing the tip of the iceberg, and attitudes, traits, and motives lying below the waterline. That means knowledge and skills are easier to observe and therefore to learn than for example attitudes, since these represent “deeper-lying personal characteristics (Bergenhengouwen, 1996).

Frameworks on digital competence have a strong focus on the technology, which is implied by the adjective “digital” in “digital competence”. For example, the 21 competencies in the DigComp framework are all related to digital technologies. Likewise, all five competence areas in Guitert, Romeu, and Cola’s (2020) framework for unemployed citizens include the term “digital”. This has already resulted in a transformation of competencies, such as “digital communication” instead of just “communication”, or “digital problem solving” instead of “problem solving”. While this focus on technology is by no means wrong, it undermines the relevance of former non-digital skills for the individual. These non-digital skills, or soft skills, are in increasing demand in the labour market (Centeno et al., 2019; Kluzer & Priego, 2018; Succi & Canovi, 2020). Today, managers need soft skills, not only for competent performance in their job, but also for operating in today’s society. Latest studies have highlighted the relevance of soft skills for digital competence (Blanka, Krumay, & Rueckel, 2022; Nowacka & Rzemieniak, 2022; Peiro & Martinez-Tur, 2022). Therefore, splitting skills into digital and non-digital skills seems more suitable for understanding the digital competence

of managers. While the non-digital skills represent the soft skills that managers require at work and in everyday life, the more technology related skills can be summarized as e-leadership skills that stand for the new skills of managers in a virtual work environment.

Despite the fact that the analysis of literature resulted in 19 pertinent areas of digital competence, some of them still share a great deal of content and are therefore difficult to separate. Instead of seeking out distinct areas, one goal was to outline as many different facets of the digital competence concept as possible in order to provide concept clarification. Therefore, a larger number of building blocks shows that the focus is on the vast variety of digital competence in a management context.

6. Theoretical Contribution

Despite leadership being one of the most studied topics in organizational science, digital competence is still a relatively new and unstudied phenomenon. Richer accounts of characteristics and skills of leaders in a digital era have been developed by scholars like Van Wart et al. (2019) or McCarthy, Sammon, and Alhassan (2021) under the concept of e-leadership or digital leadership. Likewise, the existing digital competence frameworks either address general citizens (Ferrari, 2012), students (Calvani et al., 2008), or teachers (Krumsvik, 2008). This paper contributes to the understudied area of digital competencies in the management and leadership literature and extend the scope of previous work by considering e-leadership and soft skills, among technological knowledge, as parts of digital competence.

While the importance of technological knowledge has already been considered in prior models of digital competence, the role of soft skills is still in its infancy, even though they are in higher demand after the COVID-19 pandemic (e.g. Segura Rondan et al., 2022). Only a few recent studies regard soft skills as important part of digital competence (e.g. Blanka, Krumay, & Rueckel; 2022). By integrating the soft skill dimension in the competence model, the paper contributes to this research stream and exemplifies how soft skills can be applied in a digital context, which has not yet been made sufficiently explicit in the DigComp framework. In this regard, it is also essential to differentiate between face-to-face communication skills and digital communication skills. While the former can be classified as soft skill that managers need also in everyday life, the latter one refers more to e-leadership due to the technical component. This separation is in line with the research that regards face-to-face and digital communication as different theoretical constructs (Dirani et al., 2021; Oberländer & Bipp, 2022; Wang et al, 2021).

In the context of e-leadership, the study considers the role of modern managers as ‘e-leaders’ and identified the skills that must be mastered to successfully lead in virtual work environments. Though virtual teams have been studied in the e-leadership literature (Raghuram et al., 2019), there is little prior research that examines the effects of virtual work exclusively from a managerial perspective. Likewise, the COVID-19 pandemic has dramatically increased the amount of virtual work and forced managers to modify their leadership styles in response (Contreras, Baykal, & Abid, 2020; Cortellazzo, Bruni, & Zampieri, 2019). In light of how these skills differ from those needed in a traditional environment, this study improved understanding of the role of a manager and the fundamental skills required in virtual environments.

7. Practical Implications

In terms of practical implications, this digital competence model can help organizations in better understanding the importance of technological knowledge, soft skills, and e-leadership skills for their managers in times of digitalization. Research has pointed out that HR departments are especially unsure of how to deal with soft skills (Centeno et al., 2019). This model can assist organizations in developing instruments to evaluate and track current levels of digital competence of their managers for the best possible support in developing their full potential even in situations requiring high levels of such competencies. The digital competence model can be used by practitioners to identify the type of digital competence required in particular organizations. HR managers, for example, may determine the requirements for managerial positions or estimate the potential for growth in the present and future workforce. By giving a more accurate picture of the current level of digital competence in managers, adding specifically pertinent competencies for each job profile based on this model could improve needs analyses in personnel recruiting (Campion et al., 2011). The development and implementation of more effective and efficient customized training could be facilitated, for example, by knowing the specific digital competencies that job applicants require at the company for which they are applying (Redmond, 2013).

Furthermore, training and development for business students who aim for managerial positions afterwards as well as continuous training for managers is essential. As a result, the findings of this study can be used as a foundation for creating customized training for each learner's unique needs in terms of prior knowledge, time constraints, and other factors. Training programmes based on this model support the growth of technological knowledge, soft skills, and e-leadership skills of students and managers involved in VET and continuous training processes. This is critical for reducing the digital skills gap of adequate professionalism on the labour market in light of the digital transformation.

8. Conclusion

This research builds upon already-existing frameworks of digital competence, such as the DigComp framework (Vuokari et al., 2016), and demonstrates that the vast amount of digital technologies has changed the requirements for managerial competencies. Considering also the impact of the pandemic, soft skills and e-leadership skills have become highly important for managers. The need for new competencies has been caused by managers' active roles in utilizing digital opportunities and their empowerment (Davison & Ou, 2017; Legner et al., 2017). Managers have a significant impact on how organizations address change. Therefore, in order for managers to participate in tasks and processes that go beyond technological knowledge, they must also possess soft and e-leadership skills (Centeno et al., 2019; Fernández-Arias et al., 2021; Torre & Sarti, 2020). Only knowledge and skills in all three dimensions let managers understand the effects of digitalization on the organization and will help them to make better corporate decisions in a fast-changing environment.

The systematic effort to combine technological knowledge, soft skills, and e-leadership with digital competence resulted into a three-dimensional model for managers. However, this model is preliminary and conceptual and will require empirical studies to verify its contributions to prediction of managerial effectiveness. For instance, it is not yet clear how the different building blocks of the model are interrelated. Future empirical research needs to address this question to reveal the underlying factor structure of digital competence in an organization. Through factor analysis, similar

building blocks can be merged and improve the structure of the model. However, a model with more areas has the advantage of highlighting more varied facets of the digital competence construct. Each management position necessitates a particular set of knowledge and skills suggested from the model, but there is probably no job position that requires the maximum of all 19 building blocks. Furthermore, the current model treats all 19 building blocks as equally important for managers. Future research could conduct a survey in business universities and in organizations to investigate if some building blocks are more relevant than others, or, if important types of soft and e-leadership skills that are not yet included should be considered in the model as well.

9. References

- Ala-Mutka, K. (2011). Mapping digital competence: Towards a conceptual understanding. Luxembourg: Publications Office of the European Union.
- Antón-Sancho, Á., Vergara, D., & Fernández-Arias, P. (2021). Self-assessment of soft skills of university teachers from countries with a low level of digital competence. *Electronics*, 10(20), 2532.
- Avolio, B. J., Kahai, S., & Dodge, G. E. (2000). E-leadership: Implications for theory, research, and practice. *The Leadership Quarterly*, 11(4), 615-668.
- Avolio, B. J., Sosik, J. J., Kahai, S. S., & Baker, B. (2014). E-leadership: Re-examining transformations in leadership source and transmission. *The Leadership Quarterly*, 25(1), 105-131.
- Bak, O., Jordan, C., & Midgley, J. (2019). The adoption of soft skills in supply chain and understanding their current role in supply chain management skills agenda: A UK perspective. *Benchmarking: An International Journal*, 26(3), 1063-1079.
- Bartel, J. (2018). Teaching soft skills for employability. *TESL Canada Journal*, 35(1), 78-92.
- Berenstein, A. T., Navarro, E. R., Berenstein, Z. T., Díaz, R. E. B., & Callejas-Torres, J. C. (2020). Relevance of Soft Skills to Graduate Performance: A Systematic Literature Review. *PalArch's Journal of Archaeology of Egypt/Egyptology*, 17(6), 5627-5639.
- Bergenhengouwen, G. J. (1996). Competence development-a challenge for HRM professionals: core competences of organizations as guidelines for the development of employees. *Journal of European Industrial Training*, 20(9), 29-35.
- Blanka, C., Krumay, B., & Rueckel, D. (2022). The interplay of digital transformation and employee competency: A design science approach. *Technological Forecasting and Social Change*, 178, 121575.
- Brečko, B., Ferrari, A., Vuorikari, R., & Punie, Y. (2016). The digital competence framework for consumers. Joint Research Centre Science for Policy Report.
- Calvani, A., Cartelli, A., Fini, A., & Ranieri, M. (2008). Models and instruments for assessing digital competence at school. *Journal of e-Learning and Knowledge Society*, 4(3), 183-193.
- Campion, M. A., Fink, A. A., Ruggeberg, B. J., Carr, L., Phillips, G. M., & Odman, R. B. (2011). Doing competencies well: Best practices in competency modeling. *Personnel Psychology*, 64(1), 225-262.
- Cartelli, A. (2010). Frameworks for digital competence assessment: Proposals, instruments, and evaluation. In *Proceedings of Informing Science & IT Education Conference (InSITE)*, pp. 561-573.
- Cascio, W. F., & Montealegre, R. (2016). How technology is changing work and organizations. *Annual Review of Organizational Psychology and Organizational Behavior*, 3, 349-375.

- Cassidy, J. (2021). Why Do We Still Call Them Soft Skills? Available at: <https://www.forbes.com/sites/forbesbusinesscouncil/2021/12/01/why-do-we-still-call-them-soft-skills/?sh=39c701917ec4>
- Cedefop (2021). Digital, greener and more resilient: insights from Cedefop's European skills forecast. Luxembourg: Publications Office. Available at: <https://www.cedefop.europa.eu/en/publications-andresources/publications/4201>
- Centeno, C., Vuorikari, R., Punie, Y., Kluzer, S., Vitorica, A., Lejarzegi, R., Martínez de Soria, I., & Bartolome, J. (2019). Developing digital competence for employability: Engaging and supporting stakeholders with the use of DigComp (No. JRC118711). Joint Research Centre (Seville site).
- Claxton, G., Costa, A., & Kallick, B. (2016). Hard thinking about soft skills. *Educational leadership*, 73(6), 60-64.
- Contreras, F., Baykal, E., & Abid, G. (2020). E-leadership and teleworking in times of COVID-19 and beyond: What we know and where do we go. *Frontiers in Psychology*, 11, 590271.
- Cortellazzo, L., Bruni, E., & Zampieri, R. (2019). The role of leadership in a digitalized world: A review. *Frontiers in Psychology*, 10, 1938.
- Curtarelli, M., Gualteiri, V., Shater Jannati, M., & Donlevy, V. (2017). ICT for work: Digital skills in the workplace. A study for the European Commission.
- Davison, R. M., & Ou, C. X. (2017). Digital work in a digitally challenged organization. *Information & Management*, 54(1), 129-137.
- Dirani, K. M., Abadi, M., Alizadeh, A., Barhate, B., Garza, R. C., Gunasekara, N., Ibrahim, G., & Majzun, Z. (2020). Leadership competencies and the essential role of human resource development in times of crisis: a response to Covid-19 pandemic. *Human Resource Development International*, 23(4), 380-394.
- European Commission. (2006). Recommendations of the European Parliament and the Council on Key Competencies for Lifelong Learning. Available at: <https://eur-ex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:394:0010:0018:en:PDF>
- European Commission (2022). Digital Economy and Society Index (DESI) 2022. Available at: <https://digital-strategy.ec.europa.eu/en/library/digital-economy-and-society-index-desi-2022>
- Fernández-Arias, P., Antón-Sancho, Á., Vergara, D., & Barrientos, A. (2021). Soft skills of American university teachers: Self-concept. *Sustainability*, 13(22), 12397.
- Ferrari, A. (2012). Digital competence in practice: An analysis of frameworks. Luxembourg: Publications Office of the European Union.
- Ferrari, A. (2013). DIGCOMP: A framework for developing and understanding digital competence in Europe. Luxembourg: Publications Office of the European Union, 2013.
- Findeisen, S., & Wild, S. (2022). General digital competences of beginning trainees in commercial vocational education and training. *Empirical Research in Vocational Education and Training*, 14(1), 1-21.
- Gallardo-Echenique, E. E., de Oliveira, J. M., Marqués-Molias, L., Esteve-Mon, F., Wang, Y., & Baker, R. (2015). Digital competence in the knowledge society. *MERLOT Journal of Online Learning and Teaching*, 11(1).
- Gerasimenko, V. V., & Razumova, T. O. (2020). Digital competencies in management: a way to superior competitiveness and resistance to changes. *Serbian Journal of Management*, 15(1), 115-126.
- Godhe, A. L. (2019). Digital literacies or digital competence: Conceptualizations in Nordic curricula. *Media and Communication*, 7(2), 25-35.
- González Vázquez, I. (2019). The changing nature of skills and work in the digital age. Luxembourg: Publications Office of the European Union, 2019.
- Gray, J., & Rumpe, B. (2017). Models for the digital transformation. *Software System Model*, 16(2), 307-308.

- Gruzdev, M. V., Kuznetsova, I. V., Tarkhanova, I. Y., & Kazakova, E. I. (2018). University Graduates' Soft Skills: The Employers' Opinion. *European Journal of Contemporary Education*, 7(4), 690-698.
- Guitert, M., Romeu, T., & Colas, J. F. (2020). Basic digital competences for unemployed citizens: conceptual framework and training model. *Cogent Education*, 7(1), 1748469.
- Hatlevik, O. E., Ottestad, G., & Throndsen, I. (2015). Predictors of digital competence in 7th grade: a multilevel analysis. *Journal of Computer Assisted Learning*, 31(3), 220-231.
- Ilomäki, L., Paavola, S., Lakkala, M., & Kantosalo, A. (2016). Digital competence—an emergent boundary concept for policy and educational research. *Education and Information Technologies*, 21(3), 655-679.
- Iordache, C., Mariën, I., & Baelden, D. (2017). Developing digital skills and competences: A quick-scan analysis of 13 digital literacy models. *Italian Journal of Sociology of Education*, 9(1), 6–30.
- Jameson, J., Rumyantseva, N., Cai, M., Markowski, M., Essex, R., & McNay, I. (2022). A systematic review, textual narrative synthesis and framework for digital leadership research maturity in Higher Education. *Computers and Education Open*, 100115.
- Jennings, M. (2020). The oil and gas industry, the competence assessment of Offshore Installation Managers (OIMs) and Control Room Operators (CROs) in emergency response, and the lack of effective assessment of underpinning technical knowledge and understanding. *Journal of Loss Prevention in the Process Industries*, 65, 104090.
- Kampylis, P., Punie, Y., & Devine, J. (2015). Promoting effective digital-age learning-A European framework for digitally-competent educational organisations (No. JRC98209). Joint Research Centre (Seville site).
- Khan, F., & Vuopala, E. (2019). Digital competence assessment across generations: A Finnish sample using the digcomp framework. *International Journal of Digital Literacy and Digital Competence (IJDLDC)*, 10(2), 15-28.
- Kluzer, S., & Priego, L. P. (2018). Digcomp into action: Get inspired, make it happen. A user guide to the European digital competence framework (No. JRC110624). Joint Research Centre (Seville site).
- Koltko-Rivera, M. E. (2004). Personality theory and human factors research. Human performance, situation awareness and automation: Current research and trends, 2, 261-265.
- Krumsvik, R. (2008). Situated learning and teachers' digital competence. *Education & Information Technologies*, 13(4), 279–290.
- Krumsvik, R. J. (2014). Teacher educators' digital competence. *Scandinavian Journal of Educational Research*, 58(3), 269-280.
- Legner, C., Eymann, T., Hess, T., Matt, C., Böhmman, T., Drews, P., Mädche, A., Urbach, N., & Ahlemann, F. (2017). Digitalization: opportunity and challenge for the business and information systems engineering community. *Business & Information Systems Engineering*, 59(4), 301-308.
- Levasseur, R. E. (2013). People skills: Developing soft skills - A change management perspective. *Interfaces*, 43(6), 566-571.
- Li, Y., & Ranieri, M. (2010). Are 'digital natives' really digitally competent? A study on Chinese teenagers. *British Journal of Educational Technology*, 41(6), 1029-1042.
- Liu, C., Ready, D., Roman, A., Van Wart, M., Wang, X., McCarthy, A., & Kim, S. (2018). E-leadership: an empirical study of organizational leaders' virtual communication adoption. *Leadership & Organization Development Journal*, 39(7), 826-843.
- Marrero, O., Mohamed, R., & Jordi, X. (2018). Soft skills: necessary for the integral training of the university student. *Revista científica ECOCIENCIA*, 1-19.
- Martin, A., & Grudziecki, J. (2006). DigEuLit: Concepts and tools for digital literacy development. *Innovation in Teaching and Learning in Information and Computer Sciences*, 5(4), 249-267.

- McCarthy, P., Sammon, D., & Alhassan, I. (2021). Digital transformation leadership characteristics: A literature analysis. *Journal of Decision Systems*, 1-31.
- Moorthy, S., & Polley, D. E. (2010). Technological knowledge breadth and depth: performance impacts. *Journal of Knowledge Management*, 14(3), 359-377.
- Moreira, F., Ferreira, M. J., & Seruca, I. (2018). Enterprise 4.0—the emerging digital transformed enterprise?. *Procedia Computer Science*, 138, 525-532.
- Murawski, M., & Bick, M. (2017). Digital competences of the workforce—a research topic?. *Business Process Management Journal*, 23(3), 721-734.
- Neumeyer, X., & Liu, M. (2021). Managerial competencies and development in the digital age. *IEEE Engineering Management Review*, 49(3), 49-55.
- Nowacka, A., & Rzemieniak, M. (2022). The impact of the VUCA environment on the digital competences of managers in the power industry. *Energies*, 15(1), 185.
- Oberländer, M., Beinicke, A., & Bipp, T. (2020). Digital competencies: A review of the literature and applications in the workplace. *Computers & Education*, 146, 103752.
- Oberländer, M., & Bipp, T. (2022). Do digital competencies and social support boost work engagement during the COVID-19 pandemic?. *Computers in Human Behavior*, 130, 107172.
- Peiró, J. M., & Martínez-Tur, V. (2022). ‘Digitalized’ Competences. A Crucial Challenge beyond Digital Competences. *Journal of Work and Organizational Psychology*, 38(3), 189-199.
- Periáñez-Cañadillas, I., Charterina, J., & Pando-García, J. (2019). Assessing the relevance of digital competences on business graduates’ suitability for a job. *Industrial and Commercial Training*, 51(3), 139-151.
- Pettersson, F. (2017). On the issues of digital competence in educational contexts—a review of literature. *Education and Information Technologies*, 23(3), 1005-1021.
- Raghuram, S., Hill, N. S., Gibbs, J. L., & Maruping, L. M. (2019). Virtual work: Bridging research clusters. *Academy of Management Annals*, 13(1), 308-341.
- Rauner, F. (2007). Practical Knowledge and Occupational Competence. *European Journal of Vocational Training*, 40(1), 52-66.
- Redecker, C. (2017). European framework for the digital competence of educators: DigCompEdu (No. JRC107466). Joint Research Centre (Seville site).
- Redmond, E. (2013). Competency models at work: The value of perceived relevance and fair rewards for employee outcomes. *Human Resource Management*, 52(5), 771-792.
- Reisoğlu, İ., & Çebi, A. (2020). How can the digital competences of pre-service teachers Be developed? Examining a case study through the lens of DigComp and DigCompEdu. *Computers & Education*, 103940.
- Roman, A. V., Van Wart, M., Wang, X., Liu, C., Kim, S., & McCarthy, A. (2019). Defining e-leadership as competence in ICT-mediated communications: an exploratory assessment. *Public Administration Review*, 79(6), 853-866.
- Romero-Tena, R., Barragán-Sánchez, R., Llorente-Cejudo, C., & Palacios-Rodríguez, A. (2020). The Challenge of Initial Training for Early Childhood Teachers. A Cross Sectional Study of Their Digital Competences. *Sustainability*, 12(11), 4782.
- Schutz, W. C. (1958). On categorizing qualitative data in content analysis. *Public Opinion Quarterly*, 22(4), 503-515.
- Schwarz Müller, T., Brosi, P., Duman, D., & Welp, I. M. (2018). How does the digital transformation affect organizations? Key themes of change in work design and leadership. *Management Review*, 29(2), 114-138.
- Segura Rondan, L. C., Cadenillas Albornoz, V., Zavala Alfaro, F. E., Zavala Alfaro, B. S., & Arellanos Tafur, O. N. (2022). Soft skills and digital competencies in teacher professional development in times of a COVID-19 pandemic. *International Journal of Early Childhood Special Education*, 14(1), 64-73.

- Singh, N., Hu, C., & Roehl, W. S. (2007). Text mining a decade of progress in hospitality human resource management research: Identifying emerging thematic development. *International Journal of Hospitality Management*, 26(1), 131-147.
- Soldatova, G. V., & Rasskazova, E. I. (2014). Assessment of the digital competence in Russian adolescents and parents: Digital Competence Index. *Psychology in Russia*, 7(4), 65-74.
- Spante, M., Hashemi, S. S., Lundin, M., & Algers, A. (2018). Digital competence and digital literacy in higher education research: Systematic review of concept use. *Cogent Education*, 5(1), 1519143.
- Strauss, J. (1998). Computed and digital radiography. *Journal of Digital Imaging*, 11(Suppl 1), 236.
- Succi, C., & Canovi, M. (2020). Soft skills to enhance graduate employability: comparing students and employers' perceptions. *Studies in Higher Education*, 45(9), 1834-1847.
- Süße, T., Wilkens, U., Hohagen, S., & Artinger, F. (2018). Digital competence of stakeholders in Product-Service Systems (PSS): Conceptualization and empirical exploration. *Procedia CIRP*, 73, 197-202.
- Torre, T., & Sarti, D. (2020). The "way" toward e-leadership: Some evidence from the field. *Frontiers in Psychology*, 11, 554253.
- Vaismoradi, M., Turunen, H., & Bondas, T. (2013). Content analysis and thematic analysis: Implications for conducting a qualitative descriptive study. *Nursing & Health Sciences*, 15(3), 398-405.
- Van Wart, M., Roman, A., Wang, X., & Liu, C. (2017). Integrating ICT adoption issues into (e-) leadership theory. *Telematics and Informatics*, 34(5), 527-537.
- Van Wart, M., Roman, A., Wang, X., & Liu, C. (2019). Operationalizing the definition of e-leadership: identifying the elements of e-leadership. *International Review of Administrative Sciences*, 85(1), 80-97.
- Vears, D. F., & Gillam, L. (2022). Inductive content analysis: A guide for beginning qualitative researchers. *Focus on Health Professional Education: A Multi-disciplinary Journal*, 23(1), 111-127.
- Vieru, D., Bourdeau, S., Bernier, A., & Yapo, S. (2015). Digital competence: A multi-dimensional conceptualization and a typology in an SME context. In *2015 48th Hawaii International Conference on System Sciences*, pp. 4681-4690.
- Vuorikari, R., Punie, Y., Gomez, S. C., & Van Den Brande, G. (2016). DigComp 2.0: The digital competence framework for citizens. Update phase 1: The conceptual reference model (No. JRC101254). Joint Research Centre (Seville site).
- Wang, B., Liu, Y., Qian, J., & Parker, S. K. (2021). Achieving effective remote working during the COVID-19 pandemic: A work design perspective. *Applied Psychology*, 70(1), 16-59.
- Webster, J., & Watson, R. T. (2002). Analyzing the past to prepare for the future: Writing a literature review. *MIS Quarterly*, xiii-xxiii.
- White, M. (2012). Digital workplaces: Vision and reality. *Business Information Review*, 29(4), 205-214.