

# A Qualitative Study on the Categorisation and Prioritisation of Digital Competencies and Attitudes for Managers and Employees

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**Keywords:** Digital Competencies, Digital Skills, Digital Attitude, Digital Mindset, Company, Leader, Employee.

**Abstract:** Digital transformation is a mega-trend and is perceived by many companies as an opportunity to remain competitive. The digital competencies and digital mindset of managers and employees play an important role. Without new competencies and changed attitudes, the transformation cannot be driven forward. Research on digital transformation competencies in the field of companies is limited and little evidence exists on which digital competencies, and skills are particularly important for companies. In this study, a systematic literature review was used to identify digital competencies and attitudes and classify them into six categories. With a focus group discussion, four digitalisation experts evaluated them by classifying and prioritising the competencies and attitudes on the pre-defined classifications. The results show that the majority of the identified competencies and attitudes are crucial for both managers and employees. For this purpose, the personal competencies, digital mindset and personality traits should be considered separately in order to investigate correlations in future research.

## 1 INTRODUCTION

Companies in all sectors are affected by the current trend of digital transformation (DT). In this context, the term digital transformation is increasingly used to describe the major changes organisations are undergoing in the digital age (Osmundsen, Iden, & Bygstad, 2018). The transformation is motivated and inspired by emerging digital technologies, changes in the competitive landscape (Sebastian, et al., 2017) and the increasing customer focus (Osmundsen et al., 2018). To manage digital transformation, companies should develop their skills and knowledge (Osmundsen, 2020). An important prerequisite for a successful digital transformation is a collection of skills, abilities and attitudes for problem solving in a specific context (Pawlowski & Holtkamp, 2012). However, research on which competencies are essential for DT is limited, as is research on how established companies can acquire these competencies (Butschan, Heidenreich, Weber, & Kraemer, 2018; Shahlaei, Rangraz, & Stenmark, 2017).

DT involves the use and integration of new digital technologies into business processes to enable significant business improvements (Schwertner,

2017) and often requires a transformation of the workforce (Eden, Casey, Burton-Jones, & Draheim, 2019). As digital transformation requires not only strong leadership but also rational decision-making and strong employee competencies, exploring the specifics of digitalisation, especially from a change management perspective, is very relevant (Egor, 2020). Moreover, in addition to structural changes, there is also the change in employee roles and competencies, which play an essential role in the introduction of new technologies in the company (Vial, 2019). In doing so, they are sometimes trapped in cultural heritage because it has worked well for a long time. Companies invest a lot in training their employees to deal with change (Von Ohain, 2019). However, leadership in the digital age is above all a question of inner attitude. Similar to the frequent assertion that a good leader must first be able to successfully lead himself or herself, digital leadership first requires a distinct digital mindset that creates sufficient openness for the upcoming innovations (Eggers & Hollmann, 2018). While many studies have not considered narrowing down to employees and managers (Osmundsen, 2020; Müller et al., 2019; Foster et al., 2018; Hellwig et al., 2020; Grevtseva et al., 2021; Weber et al., 2017), the present work

distinguished between managers and employees in order to create individual competence profiles for specific job roles. For this purpose, digital attitudes were included in this work in addition to digital competencies.

To identify digital competencies and attitudes, a systematic literature review (see chapter 2 Method) was conducted. The identified competencies with focus of attitudes were divided into six categories. With a focus group discussion, they were presented to digital experts who were asked to rank them on the classifications and prioritise them. The results show that many competencies and attitudes overlap for both managers and leaders. These competencies and attitudes can be applied to specific sectors to define concrete competencies and attitudes.

In the first part, the background of digital competencies in companies is presented, which are then divided into classifications. Since the digital mindset also plays an important role in the digital transformation, the attitudes that are necessary for a successful digital transformation were elaborated and also divided into a classification. Based on this, the approach of the study is presented, which consists of a systematic literature review and a focus group discussion. Finally, the results are presented and critically reflected.

## 2 METHOD

To identify digital competencies and attitudes, a systematic literature search was conducted, which describes a method for reviewing relevant articles based on clearly formulated research questions, themes or phenomena (Kitchenham, et al., 2009), (Webster & Watson, 2002). In total, there were 23,168 publications. According to the inclusion criteria there were 133 papers and according to the exclusion criteria there were 19. Six papers were added by the forward and backward search. 25 publications were selected for analysis based on the scope of the study (Boger & Mercer, 2017) and the inclusion and exclusion criteria. A web-based automated search through digital libraries (Kitchenham, et al., 2009) was used. For digital competence and digital mindset-based scholarly articles in the company published in scholarly databases. Three main databases (AIS, ACM & IEEE) focusing on information systems and computer science were searched between the period of 2014-2021 to find the current results.

In addition, a forward and backward Webster & Watson, 2002) search was carried out, as some papers

were often cited. The following keywords were used to search the IEEE and ACM databases: (digital competencies AND company) OR (digital literacy OR digital skills) OR (craft industry OR craft enterprises) AND (digital mindset OR digital attitude). For the AIS database, the following keywords were used because no hits were found for the other keywords: (digital competencies AND company) OR (digital literacy OR digital skills) OR (craft industry OR craft enterprises) OR (digital mindset OR digital attitude). Furthermore, a publication was selected as a source for the analysis process if the proposed inclusion criteria were met; a publication was removed from the reference list if it met the predefined exclusion criteria. Following the research questions and guidelines for reviewing publications, the inclusion and exclusion criteria are as follows: The inclusion criteria are peer-reviewed paper (journal or conference), explicit mention of generational terms in abstract, title or keywords, and collaboration between groups in the context of digitisation. The exclusion criteria are non-English language, no explicit mention of digital skills or digital mindset; paper incomplete as paper in progress and no scientific methodology available (Okoli & Schabram, 2010).

The digital competencies and attitudes identified in the literature were divided into six classifications (Tahvanainen & Luoma, 2018) (personal competencies, professional competencies, technical skills, technological competencies, communication competencies, information-processing competencies). A focus group discussion with digitalisation experts was conducted in order to be able to assign the digital competencies and attitudes for managers and employees to the categories. The external validity focuses on the quality of the results identified through the literature. The focus group discussion was chosen because it is used to evaluate and further develop products and services (Henseling, Hahn, & Nolting, 2006), to evaluate measures and their improvement (Schulz, Mack, & Renn, 2012), to evaluate differences of opinion (Dürrenberger & Behringer, 1999) and to conduct acceptance analyses (Schulz et al. 2012). In addition, focus groups remain at the first level of information and are therefore very suitable for the analysis of e.g. organisational processes or structural analyses.

Two focus group discussions were conducted for the study. The experts came from the university context and have experience in the field of digitalisation and consulting in the company. In the first focus group discussion, four experts participated. Of these, two were female and eight

were male. The ages of the experts were between 23-50 years. Eight of the experts are research assistants with a focus on digitalisation, one expert is a digitalisation consultant and one expert is a professor in the field of digitalisation. In the second part, there were six participants. In the first session, the experts were asked to rank and prioritize the digital competencies and digital mindset of the managers on the Miro board. Two figures (employee, manager) were created and all competencies and attitudes were assigned and prioritised with the help of stickers to the respective classifications that are important for managers and employees. They were also asked to carry out the same procedure for the employees in round two. The sample was  $N=10$ . For this purpose, six digital competencies and mindset classifications were created, which were published on a virtual Miro-Board. In the first round, the experts were asked to classify the digital competencies and mindset for managers into the categories. In the second round, the experts were asked to categorize the same competencies and attitudes for employees. After the categorisation, open discussion questions were asked about digital competencies and attitudes. For the discussion, the following open questions were asked to check for comprehensibility and to add any missing competencies and statements:

Table 1: Summary of the questions.

Questions For Focus Group Discussion
Do you find the six classifications understandable? In your opinion, are there still digital competencies and attitudes for leaders/employees that should be added?
If yes, what would they be? To which classification would you assign them?
Do you think the classification of personal competencies/attitudes and personality traits as a whole or separately makes sense?
If yes, which personal competencies could you imagine for leaders/ employees?
What character traits would you see for personality traits that are relevant for digitalization?
What attitudes would you see for digital mindset that are relevant for digitalization?

In addition to the open questions, the experts were asked to rank the digital competencies and attitudes according to low and high priority. This ranking should later reflect the current importance of digital

competencies and attitudes. Six experts participated in the group discussion, which was then recorded with an audio device, transcribed and categories were formed. These categories were used to extract the most important statements in order to expand the competencies and attitudes if necessary.

### 3 DIGITAL COMPETENCIES IN COMPANIES

DT is the process of adopting and integrating new digital technologies into business processes to enable business improvements (Reis, Amorim, Melao, & Matos, 2018), which in turn requires new competencies (Butschan, Heidenreich, Weber, & Kraemer, 2018; Vial, 2019). Digital competencies have become an important concept in the discussion about what skills and understanding people should have in the knowledge society, reflecting ideas about future requirements in which new technologies are understood as opportunities (Punie, 2007). Digital competencies are the bundling of a company's collective competencies that are necessary for the digital transformation process (Osmundsen, 2020), which is also pursued in this study. DT involves the use and incorporation of new digital technologies into business processes to enable significant business improvements (Schwertner, 2017) and often requires a transformation of the workforce (Eden et al., 2019). As digital transformation requires not only strong leadership but also rational decision-making and strong employee competencies, exploring the specifics of digitalisation, especially from the perspective of transforming business leadership, is very relevant (Egor, 2020). Furthermore, in addition to structural changes, there is also the change in employee roles and competencies (Vial, 2019). When new digital technologies are introduced in a company, new skills are needed (Vial, 2019). Competencies related to managing, operating and interacting with new machines and media, so-called "digital literacy", are fundamentally desirable in a rapidly changing environment (Plumanns, Janssen, Vossen, & Isenhardt, 2019). This is also evident in sales staff, who are undergoing a transformation due to technological advances, leading to a new field of digital literacy (Ilomäki, Paavola, Lakkala, & Kantosalo, 2016). To increase digital competencies, organisations should build their own digital talents. These can be developed by training internal resources or acquiring external resources (Andriole,

2018). Key competencies for employees include 'leading and deciding', 'supporting and collaborating', 'interacting and presenting', 'analysing and interpreting', 'creating and conceptualising', 'organising and executing', 'adapting and coping', 'being enterprising' and 'performing' (Prifti et al., 2017). In an established company, the competencies identified were teamwork, cooperation, strategic thinking, interpersonal communication and relationship building. (Murawski, Bühler, Blatz, & Bick, 2019). Responsibility is also identified as a component of digital competence required in the digital world. Four types of digital competencies have been defined for this purpose: Information and media literacy, communicative competence, technical competence and consumer competence (Grevtseva et al., 2021). Cloud integration skills should also be created to increase competitiveness (Mitra, O'Regan, & Sarpong, 2018). The lack of cloud-based skills also negatively impacts businesses, competitiveness and the economy (Blackwood, 2016). Research on digital transformation skills is limited (Butschan, Heidenreich, Weber, & Kraemer, 2018) and there is little knowledge about which digital competencies and skills are particularly important for companies (Butschan, Heidenreich, Weber, & Kraemer, 2018; Shahlaei, Rangraz, & Stenmark, 2017).

In summary, digital transformation cannot be driven without digital competencies of managers and employees. As there is a multitude of digital competencies in the literature, the following chapter classifies the identified competencies and assigns them to the respective classifications.

### 3.1 Classifications of Digital Competencies

The literature shows a variety of digital competencies that are relevant for managers as well as for employees in a company. For this reason, the identified digital competencies were divided into five categories (communication competencies, professional skills, information processing competencies, technical skills, and technological competencies). The classifications professional competencies and technological competencies were derived from the research of (Tahvanainen & Luoma, 2018). These classifications were chosen because they cover the most important requirements for employees and managers (Prifti et al., 2017). The classifications communication competencies, information processing competencies and technical

skills were added as they are important categories for the classification of competencies. communication competence focuses on an individual's ability to respond to a conversational situation by demonstrating skills relevant to the conversational situation and context (Salleh, 2008). This means that a person is communicatively competent if the appropriate communication knowledge is available. Developing these skills requires adaptation to the particular requirements of each communication situation.

Table 2: Classification of digital competencies.

Classification and Competencies
<p><b>Communication Competencies</b>                      Digital communication (Hellwig et al., 2020; acatech, 2016; Plumanns et al., 2019; Hummert et al., 2019)                      Collaboration (Lipmann, 2020; Weber et al., 2017)                      Teamwork (Lipmann, 2020; Weber et al., 2017; Plumanns et al., 2019, Hummert et al., 2019; Foster et al., 2018, Singh, A., &amp; Hess, T., 2017)                      Cooperation (Lipmann, 2020; Weber et al., 2017)                      Interpersonal communication (Grega &amp; Kornecki, 2015; Weber et al., 2017)                      Technical communication (Egor, 2020)                      M2M communication (acatech, 2016; Henseling et al., 2016)                      Interdisciplinary environments (acatech, 2016; Henseling et al., 2016)                      Maintain customer relationship (acatech, 2016; Henseling et al., 2016)                      Creating business network (acatech, 2016; Henseling et al., 2016)</p>
<p><b>Information Processing Competencies</b>                      Big data analytics (Henseling et al., 2016; Egor, 2020; acatech, 2016)                      Data analysis (Eggers &amp; Hollmann, 2018; Weber et al., 2017; Von Ohain, 2019; Egor, 2020; acatech, 2016; Henseling et al., 2016)                      Information seeking (Lipmann, 2020, Weber et al., 2017)                      Industry- specific analytics (Mulder, 2014)                      Data management (Mulder, 2014)                      Information competence (Grega &amp; Kornecki, 2015; Weber et al., 2017)                      Data interpretation (Weber et al., 2017; Egor, 2020; acatech, 2016; Henseling et al., 2016)                      Analysing information (Shahlaei et al., 2017)                      Compromising (Egor, 2020)                      Including data and network (Egor, 2020; acatech, 2016; Foster et al., 2018; Henseling et al., 2016)</p>

Table 2: Classification of digital competencies (cont.).

Classification and Competencies
<p><b>Technological Competencies</b>                      Digital tools (Guo, 2015; Weber et al., 2017)                      Digital devices (Guo, 2015; Weber et al., 2017)                      Digital fabrication (Guo, 2015)                      Customer service orientation (Lipmann, 2020; Smit et al., 2016; Egor, 2020; acatech, 2016; Singh &amp; Hess 2017)                      Digital technology orientation and adoption Mulder, 2014; Weber et al., 2017)                      Agile project management (Mulder, 2014)                      Safety (Weber et al., 2017)                      Digital content creation (Weber et al., 2017)                      IT- competency (Schwertner, 2017)                      Technology affinity (Grevtseva et al., 2021; acatech, 2016; Henseling et al., 2016)                      Digital security (Hummert et al., 2019)                      Knowledge about mobile technology (Hummert et al., 2019)                      Media competencies Grega &amp; Kornecki, 2015; Osmundsen, 2020)                      Analytical thinking (Egor, 2020; Lipmann, 2020)</p>
<p><b>Technical Competencies</b>                      Cloud based skills (Blackwood, 2016)                      Digital documentation (Guo, 2015)                      AI/ machine intelligence for business (Guo, 2015; acatech, 2016)                      Agile (Shahlaei et al., 2017)                      Programming knowledge (Weber et al., 2017; Egor, 2020)                      Optimization (acatech, 2016)</p>
<p><b>Professional Competencies</b>                      Strategic thinking (Lipmann, 2020)                      Portfolio management (Mulder, 2014)                      Process competence (Tahvanainen &amp; Luoma, 2018; Mulder, 2014)                      Change-management skills (Schwertner, 2017; Henseling et al., 2016; Singh &amp; Hess ,2017)                      Project management (Singh &amp; Hess, 2017)                      Stewardship of resources (Lipmann, 2020)                      Customer competence (Grega &amp; Kornecki, 2015)                      Knowledge management (Grevtseva et al., 2021)                      Self-management and organization (Hummert et al., 2019; Sebastian et al., 2017)                      Management Ability (Sebastian et al., 2017)                      Knowledge management and organisation (Grevtseva et al., 2021; Hummert et al., 2019)                      Organisational awareness (Lipmann, 2020)                      Life-long learning (Hummert et al., 2019; Foster et al., 2018)</p>

One of the important categories is technological competence, which is relevant for the digital transformation. Technological competence relates to

the level of productive forces, work and life that has been achieved, as well as the technological systems, processes and products, e.g. machines, which underlie the productive forces and relations of production. (Dahmen-Adkins & Thaler, 2019). Professional competence is considered the overarching, integrated and generalised ability to perform effectively in a specific professional activity, job, role, operational context and task situation over time (Mulder, 2014). Professionals in all fields are expected to have professional competencies; these include the ability to organise one's own work, analytical skills, leadership skills, teamwork skills, communication and interpersonal skills, and problem-solving skills (Tahvanainen & Luoma, 2018). The last classification of digital competencies deals with technical competencies. Technical competencies include knowledge of the methods and procedures used in the field of IT and information systems management (Tahvanainen & Luoma, 2018). The most often mentioned competencies are programming and AI/machine intelligence for enterprises. Accordingly, these competencies are the basic ones for the technical classifications.

## 4 DIGITAL MINDSET IN COMPANIES

The term digital mindset is referred to as a keyword in the context of digital transformation and expresses the need to think in a new way (Oswald & Kleinemeier, 2017). Kollmann (2020) defines digital mindset as the inner attitude and positive attitude towards existing and new digital application possibilities. Digital business transformation still has a long way to go, sometimes being trapped in the cultural legacy that has worked for a long time. Companies are investing heavily in training their employees to cope with change (Von Ohain, 2019). Leadership in the digital age is a question of inner attitude, which requires a distinct digital mindset that personality also plays an essential role (Eggers & Hollmann, 2018). In this context, the digital mindset is a factor of exponential development that makes companies successful in the long term. It is important to show employees the importance of digital transformation and mindset. The first step is to identify how pronounced the mindset of the employees is, which can be found out through different frameworks and accordingly measures or learning paths can be derived (Knorr, 2020). It is also assumed that employees' beliefs about personal and

societal factors in relation to technological progress have an influence on employees' behaviour in digital transformation measures. Accordingly, the success of digital transformation measures depends on the conscious involvement of employees in the change process (Solberg et al., 2020). For this reason, the fundamental understanding of the employees' digital mindset is of central importance. In order for the digital mindset to adapt to the corporate strategy and the future viability of the company, it should first be identified for each employee in which area they currently stand with their mindset and in which areas development and advancement opportunities are still lacking (Knorr, 2020). Digitalisation has a positive effect on perceived job satisfaction, internal capacities and organizational climate (Hummert et al., 2019). Attitudes and digital literacy show a significant positive effect on self-efficacy (Daniel, Mazanov, Meacham, Heaslip, & Hanson, 2016). One of the biggest challenges for established organisations is digital transformation if skilled and competent leadership does not manage it. Ala-Mutka (2011) develops a digital competence model for citizens and integrates the basic digital attitudes that people need for digitalisation. These basic digital mindsets include the intercultural and collaborative mindset, the critical and creative mindset and the autonomous and responsible mindset. The traits of generosity, growth, flexibility, affability, curiosity, teamwork and embracing diversity are also key factors of the digital mindset concept (Chattopadhyay, 2020). For digital leaders, the characteristics empathic, innovative, open and agile are the essential attitudes (Von Ohain, 2019). Dombrowski and Bogs (2020) add networking, participation and trust as relevant factors for digital transformation for leaders. In addition to digital attitudes for leaders, the most important factors for employees have also been identified. To become resilient, it is necessary to experience successes and failures. In this context, mindset resilience plays an important role for employees to develop a new mindset. To be able to reflect on the experiences, it is necessary to take risks. The last area is for employees to reflect on their behaviour and attitudes, because values and competencies usually do not change without a lot of effort, while professional competencies can be taught (Holtel et al., 2019). Digital Mindset is an important prerequisite for DT and represents a set of attitudes that are required. Traits, skills and attitudes are driven throughout the organisation by values, processes, structures and functions to create the necessary mindset base for digital transformation. The literature revealed that the

traits empathic, innovative, open, agile, networked, participative and trusting are prominent as relevant for leaders. According to the literature, the employee characteristics for digital transformation are resilience and risk-taking.

#### 4.1 Classifications of Digital Mindset

There are many characteristics and attitudes for the digital mindset in the literature. These were identified through a systematic literature search and listed in a classification (Tahvanainen & Luoma, 2018). (personal competence/ personality traits/ attitude).

Table 3: Classification of attitudes, personality traits and personal competencies.

Classification and Mindset
Openly dealing with failure (Holtel et al., 2020)
Resistance (Holtel et al., 2020; Singh & Hess, 2017)
Trusting instinct (Holtel et al., 2020),
Self-control and Self-confidence (Murawski et al., 2019)
Visioning (Murawski et al., 2019; Von Ohain, 2019)
Result-oriented mindset (Müller et al., 2019; Murawski et al., 2019)
Competitive and innovative mindset (Müller et al., 2019)
Enthusiastic (Von Ohain, 2019)
Respectful (Von Ohain, 2019)
Communicative (Von Ohain, 2019; Grevtseva et al., 2021; Sousa & Wilks, 2018),
Emotional intelligence (Von Ohain, 2019)
Risk-taking (Von Ohain, 2019; Petter et al., 2018)
Curious (Von Ohain, 2019)
Creativity (Erol et al., 2016; Richter et al., 2015; Kiesel & Wolpers, 2015; Von Ohain, 2019; Sousa & Wilks, 2018)
Taking responsibility (Smit et al., 2016; Petter et al., 2018; Von Ohain, 2019)
Broad-minded (Von Ohain, 2019; Petter et al., 2018)
Openness to learning (Petter et al., 2018)
Flexibility (Erol et al., 2016; acatech, 2016; Richter et al., 2015; Kiesel & Wolpers, 2015)
Inspirational skills (Singh & Hess, 2017; Tahvanainen & Luoma, 2018)

The most frequently identified personal competencies, attitudes and characteristics are visioning, communicativeness, risk-taking, curiosity,

imagination, flexibility, creativity and inspirational ability (see table 1). In order to assign these competencies and attitudes to managers and employees, a focus group discussion was conducted, which is described in the following chapter.

## 5 DIGITAL COMPETENCIES AND MINDSET FOR LEADERS

The results show that the majority of the identified competencies and attitudes are necessary for leaders to move forward in digital transformation. The prioritization revealed that among the technological competencies, digital technology acceptance, digital shares, digital technology orientation, agile project management, analytical thinking, customer service orientation and digital tools are high priority for leaders. Technology affinity, security, media literacy and digital security are in the middle priority. Digital manufacturing, digital content creation and mobile technology knowledge competencies were rated as low priority. Agility and optimization are important technical competencies for leaders. The competencies cloud-based skills, AI/machine intelligence for business and programming skills are of low relevance for executives.

The following competencies were classified as high priority: Results orientation, customer competence, self-management and organization, strategic thinking, organisational awareness, knowledge management, management skills, process improvement, project management, Change management, business acumen, process competence, lifelong learning and entrepreneurship. The experts see the competencies control of resources as less important and portfolio management in the midfield. In the field of communication competencies, the results indicate that all fields in this area were rated with high priority. This shows that communication skills are a crucial function for leaders in digital transformation. The information processing competencies results were also classified with a high weighting, with the exception of Inclusive Data and Network.

The traits imaginative and enthusiastic were classified as low priority in the classification of personal competencies, attitudes and personality traits. Competitive Mindset also tends to be a low priority for managers. In the middle range, there are the following attitudes and personality traits: trusting instinct, transparency, adventurousness and trustworthiness. All other competencies, attitudes and

personality traits were rated as high value for leaders. This shows that in addition to competencies, attitudes and personality traits are also essential for the implementation of digital transformation.

For this reason, the comprehensibility of the classifications was discussed in the open discussion. For example, one expert (E1) commented on the personal competencies, mindset and personality traits as follows: *"I think it makes sense to separate the whole thing. Certain personality traits are defined in such a way that you cannot really change them. On the other hand, it is quite good to separate attitudes towards cognitive competencies and abilities, because it is already a different level"*. Different recommendations regarding the classifications were made during the open discussion. In addition, some competencies that are considered important for managers for digital transformation were also added. Regarding the lack of digital competencies and attitudes, the expert (E1) commented as follows: *"Therefore, there are still a lot of IT competencies that could be included, but then we still have to think about the level we want to have"*. In the digital attitudes field, the expert (E2) stated: *"Especially when you think about Ferrari's digital competence framework, so in the direction of ethics and responsibility, whether you could add something to that, especially in the area of recruitment"*. On personal competencies, the expert (E3) noted that *"vision is very important for leaders. But also flexibility"*. As important attitudes for leaders, the expert (E2) said that *"the willingness to change as relevant or also flexibility but maybe also towards digital learning and coaching and especially with ethics and responsibility"* are important aspects. Another factor for the digital attitude was that *"in the context of the data flood to which one is simply exposed to digitalization, critical thinking is becoming more and more relevant"* (E4).

According to the second focus group, digital technology orientation, analytical thinking, customer service orientation, IT competency, technology affinity, agile project management, digital security and safety are the most important competencies for managers. The competencies digital fabrication, digital technology adoption, knowledge about mobile technology, digital devices and digital tools were prioritised as less relevant. Among the technical competencies, agile, optimizing, cloud based skills and digital documentation show a high relevance for managers in digital transformation. AI/machine intelligence for business and programming were prioritised as low. Process improvement, customer competence, self-management and organisation,

result orientation, organisational awareness, management skills, lifelong learning, project management and entrepreneurship, which were classified as professional competencies, were prioritised as high. The competencies knowledge management and stewardship of resources are considered less important. In the classification of personal competencies, attitudes and personality traits, the following competencies were seen to be of high importance: Innovative mindset, taking responsibility, flexibility, openness to learning and emotional intelligence. Less relevant are the interdisciplinary environments and collaboration in the classification of communication competencies. Teamwork and creating business network are the most important for managers. The most frequently mentioned and highly prioritised information processing competencies include industry specific analytics, data analysis, compromising, data interpretation, information seeking and analysing information, whereas the experts see the competencies data management, including data and network and big data analytics as less relevant for managers. In the discussion part, questions were asked about the comprehensibility of the classifications. The expert said that it was for "*understandable*" (E2). However, there was overlap in some competencies such as "*analytical thinking*". For example, the expert commented as follows: "*It could also fit the Professional or Personal or Mindset*" (E2). In addition, one expert (E4) said that it is sometimes difficult to delimit the categories. If you have something like management skills or project management. That includes things like change management, knowledge management and the weighting is difficult. This shows that the sub-aspects of project management should be taken into account and not project management in general. When asked which competencies and attitudes for managers should be added, the participant said that "*this is really broadly covered, i.e. personal*" (E1). In this context, "*a lot of characteristics were taken and I personally would not think of any other*" (E1). Whether the classification of personal competencies, attitudes and characteristics should be separated or considered as a whole, the experts said as follows: "*If we were to separate them now, a lot of them will overlap. That's why I would keep it as a whole*" (E1). The experts (E4, E2) also confirmed this statement.

Through the two focus groups it became apparent that some competencies and attitudes for managers are reflected and also classified as high priority. These are: digital technology orientation, agile project management, IT competencies (technological

competencies), agile, optimisation (technical competencies), result orientation, customer competence, self-management and organisation, organisational awareness, management skills, process improvement, project management, life-long learning and entrepreneurship (professional competencies). Creating business network and teamwork were rated as very relevant by both focus groups (communication competencies). For information processing competencies, industry-specific analytics, information seeking, data analysis and data interpretation were prioritised highly. There is also overlap and high prioritisation in personal competencies/attitudes and characteristics. These include resistance, resilience, self-confidence and learn motivation.

## 6 DIGITAL COMPETENCIES AND MINDSET FOR EMPLOYEES

The results show that most of the identified competencies and mindsets have a high priority level. The findings of the technological competencies indicate that digital tools, IT literacy, technology affinity, digital technology adoption, digital security, media literacy, mobile technology knowledge, digital content creation and analytical thinking are the most significant competencies for employees in the near future. Agile project management, digital manufacturing, customer service orientation, security and digital technology orientation, on the other hand, are less important for employees. The most important technical skills are programming skills, agile, digital documentation and cloud-based skills. This shows that both technical and technological skills matter to employees. Personal skills, attitudes and personality traits are also crucial factors in driving digital transformation. Accordingly, the experts rated the following competencies, attitudes and characteristics as particularly crucial: initiative, self-control, self-confidence, resilience, open-mindedness, critical thinking, motivation to learn, transparency, adaptability, communicativeness, willingness to learn, results-oriented mindset, curiosity, resilience, innovative mindset, respect, performance orientation and perseverance. In the middle range are the competencies, attitudes and traits: Resourceful, emotional intelligence, trustworthy, competitive mindset, adventurous and enthusiastic. The traits instinct of trust, capacity for abstraction, willingness to take risks, flexibility, sense of responsibility,



ability to inspire, acceptance of responsibility, decisiveness, vision, open-mindedness in dealing with failure and global mindset were weighted less strongly by the experts.

The most significant among the employees' professional competencies are result orientation, knowledge management, self-management and organization, strategic thinking, lifelong learning, management skills and conceptual thinking. Customer competence was the only one rated as average by the experts. The competencies resource management, portfolio management, project management, business acumen, organizational awareness, entrepreneurship, change management and process improvement were rated as having little relevance to employees. For communication skills, all but the competencies of building a business network and maintaining client relationships were rated as high priority. The last skill, information processing, is also essential for implementing digital transformation. Therefore, employees should be able to demonstrate the competencies considering data and network, managing data, finding compromises and searching for information. The competencies analysing information and data analysis were considered a medium priority. Finally, the digitalisation experts rated data interpretation, industry-specific analytics and big data analytics as less relevant.

In the discussion part, questions were asked about the understandability of the classifications. The expert (E1) asked, *"Where is the difference between technological and technical competencies?"* According to the expert (E1), the two classifications are *"not clearly distinguishable"* and would see the technical competencies *"rather as development competencies"*. The expert (E4), in which he commented as follows, also confirmed this statement: *"I also found the differentiation between technological and technical not so obvious, and I had also added comments about individual competencies that I could not really understand what was meant by two or three terms"*. In response to the question whether the classification should consider personal competencies, mindset, personality traits as a whole or separately, the expert (E1) expressed that *"you should look at it separately"*. Regarding the question which digital competencies, mindset and personality traits are still missing, the expert (E2) answered that *"an independent way of working and dealing with complexity"* should still be added as a competence. Furthermore, the characteristics and competence *"ethics"*, knowledge *"of digital trends in*

*digitalization"* (E2) and *"adaptation"* (E3) were added.

In order to find out the relevant personality traits and digital attitudes for employees, experts were consulted. For example, the expert (E4) suspects that *"the whole digital transformation is also transferring more and more responsibility to the employees"*. The attitude of *"readiness"* (E4) is also becoming increasingly important, which is also confirmed by expert (E2). She, in turn, said, *"especially when we talk about lifelong learning, the employee has to bring in and adapt a certain space"*.

The measurement results of the second focus group in the classification of technological competencies show that digital tools, IT-competency, technology affinity, digital technology orientation, digital technology adoption, digital security, media competence, knowledge about mobile technology, digital content creation and analytical thinking are the most important competencies for employees. The lower ranked competencies include knowledge about mobile technology, digital fabrication, safety, agile project management, digital devices, digital security and digital content creation. The competencies agile and digital documentation are the most relevant technical competencies and AI/machine intelligence for business and cloud-based skills were prioritised as less relevant. In the classification of personal competencies, attitudes and characteristics, the following were given high priority: Openness to learning, openly dealing with failure, openness to learning, achievement orientation, respectful, transparency, trustworthy, self-control, adaptability, result-oriented mindset, communicative and creativity. In the low range are ability to abstract, imaginative, risk taking, curious, inspirational skills, competitive mindset, global mindset and decisiveness. The low prioritised professional skills include portfolio management, knowledge management, change management, strategic thinking, project management, management skills and entrepreneurship. The most relevant professional competencies were process improvement, customer competence, result orientation, conceptual thinking, lifelong learning, process competence, self-management and organisation. Among the information processing competencies, analysing information, big data analytics and data interpretation were ranked high and prioritised. Data management, information seeking, compromising, data analysis, industry specific analytics and information competence were classified as low. In the last classification are communication skills. Here, M2M communication and teamwork for employees were

seen as the most important competencies for digital transformation. Cooperation and interpersonal communication are less important. In the discussion round, the experts named the following as the most important characteristics for digital transformation: "openness" (E2), which was also confirmed by the expert (E1) and the characteristic "flexibility" was also seen as an important characteristic. In addition, one participant added the characteristic "persistence", saying that one must "overcome difficulties" (E3).

From both focus groups, it became clear that certain competencies and attitudes for employees were reflected and rated with high priority. Digital tools, IT competence, technology affinity, digital technology use, media competence and analytical thinking (technological competencies) were highly prioritised by both groups. For technical competencies, agility and digital documentation were ranked as important. Results orientation, self-management and organisation, lifelong learning and conceptual thinking (technical competencies) are the most important competencies for employees according to both focus groups. For personal competencies/attitudes and attributes, self-control, transparency, adaptability, communicatively, willingness to learn, result-oriented thinking, respect and performance orientation are considered relevant for both groups. For communication competencies, there is only one match and that is the ability to work in a team. There is no overlap in the information processing competencies.

## 7 DISCUSSION

The aim of this study was to allocate and prioritise the identified digital competencies, attitudes and personality traits to managers and employees with the help of digitalisation experts. The results of the study show that the majority of the identified digital competencies, attitudes and traits are relevant for both managers and employees. Different digital competencies and attitudes for employees and managers have been studied in the literature. In this context, the identified competencies (Murawski, Bühler, Blatz, & Bick, 2019; (Grevtseva, Bashtanar, Isakova, Balikaeva, & Kirillova, 2021; Butschan, Heidenreich, Weber, & Kraemer, 2018; Shahlaei, Rangraz, & Stenmark, 2017) and attitudes (Ala-Mutka, 2011; Chattopadhyay, 2020) are limited to the general public. In addition, studies have identified limited competencies and attitudes, which in turn has been extended by the present work. This study identifies the key competencies and attitudes for

managers and employees that have not been included in many works (Osmundsen, 2020; Müller et al., 2019; Foster et al., 2018; Hellwig et al., 2020; Grevtseva et al., 2021; Weber et al., 2017). For this purpose, digital attitudes were included in this work in addition to digital competencies, which the literature also does not include. In addition, a ranking of digital competencies and digital attitudes was carried out. This showed that some competencies and attitudes are more relevant for employees and others for managers. A ranking of the identified competencies and attitudes does not exist in the literature either. The identified general factors of Chattopadhyay's (2020) digital mindset concept could be extended in the present study by ranking further characteristics as crucial for digital transformation for both managers and employees. The basic characteristics and mindset of managers (Von Ohain, 2019; Dombrowski and Bogs, 2020) were added through mapping and prioritisation. The digital attitudes identified in the literature (Holtel et al., 2019) were also supplemented with new attitudes and characteristics that are important for digital transformation. When comparing the two focus groups, it became apparent that some of the competencies and attitudes overlapped. On closer inspection, it became clear that few competencies and attitudes were assigned and prioritised in the second focus group for employees and managers. Therefore, it can be said that for further research, the two focus group results should be merged and used as one instrument. The interview also pointed out that some terms should be explained in more detail and the technical classification as a development competence should be changed. Additionally, as a limitation, it can be said that the databases should be expanded in the systematic literature search. In addition, it is reasonable to carry out searches for relationships between categories. These can be relevant for the strategy and measures aimed at developing the competencies and attitudes.

## 8 SUMMARY AND FUTURE WORK

This study investigates the digital competencies and digital attitudes of managers and employees in the company. A systematic literature review was conducted to identify the existing competencies and attitudes in the literature. These were classified into six classifications to get an overview of the competencies and attitudes. Using a qualitative

research methodology, a focus group discussion with digital experts was conducted. The aim was to map and prioritise the identified digital competencies and attitudes among employees and managers. The results show that some competencies and attitudes reflect those identified in the literature. In addition, many competencies and attitudes are relevant to both employees and managers. As the study was not limited to a specific sector, the identified competencies and attitudes can be explored in the future with a qualitative methodology on a specific sector to gain new results and insights. As this work includes many classifications, a kind of ontology of digital competencies could be defined. Furthermore, it is important to find out how pronounced the digital competencies and attitudes of managers and employees are. There are various frameworks that can be used for this.

## REFERENCES

- acatech, F. u. (2016). Kompetenzentwicklungsstudie Industrie 4.0. Report.
- Ala-Mutka, K. (2011). *Mapping digital competence: Towards a conceptual understanding*. Sevilla: Institute for Prospective Technological Studies.
- Andriole, S. J. (2018). Skills and Competences for Digital Transformation. *IT Professional*, 20 (6), pp. 78-81.
- Blackwood, N. (2016). *Digital skills crises*. Second report of Session.
- Boger, J., & Mercer, K. (2017). Technology for fostering intergenerational connectivity scoping review protocol. *Systematic reviews*, 6(1), p. 250.
- Butschan, J., Heidenreich, S., Weber, B., & Kraemer, T. (2018). Tackling Hurdles to Digital Transformation- the Role of Competences for successful Industrial Internet of Things (IIoT) Implementation. *International Journal of Innovation Management*, 1950036, pp. 1-34.
- Chattopadhyay, S. (2020, 14 12). *A new way of thinking to onboard digital culture in your company*. Retrieved from <https://blog.signaturit.com/en/a-new-way-of-thinking-to-onboard-digital-culture-in-your-company>
- Dahmen-Adkins, J., & Thaler, A. (2019). Technologische Kompetenz für alle? In J. Dahmen-Adkins, & A. Thaler, *Zur Bedeutung der Technischen Bildung in Fachverbänden* (pp. 15-77). Wiesbaden: Springer Spektrum.
- Daniel, D. D., Mazanov, J., Meacheam, D., Heaslip, G., & Hanson, J. (2016). Attitude, digital literacy and Self-efficacy: Flow-on effects for online learning behavior. *The Internet and Higher Education*, 29, pp. 91-97.
- Dombrowski, H., & Bogs, N. (2020). Digital- Leadership-Index- Führung im digitalen Umfeld anschaulich und messbar machen. In M. h. Dahm, & S. Thode, *Digitale Transformation in der Unternehmenspraxis* (pp. 103-122). Wiesbaden: Springer Gabler.
- Dürrenberger, G., & Behringer, J. (1999). *Die Fokusgruppe in Theorie und Anwendung*. Baden- Württemberg: Akad für Technikfolgenabschätzung.
- Eden, R., Casey, V., Burton-Jones, A., & Draheim, M. (2019). Digital Transformation Requires Workforce Transformation. *MIS Quarterly Executive*, 18 (1), pp. 1-14.
- Eggers, B., & Hollmann, S. (2018). *Digital Leadership- Anforderungen, Aufgaben und Skills von Führungskräften in der „Arbeitswelt 4.0“*. Wiesbaden: Springer Gabler.
- Egor, P. (2020). Digital Transformation of Industrial Companies: What is Management 4.0? *ICEME 2020: 2020 The 11th International Conference on E-business, Management and Economics*, pp. 131-138.
- Erol, S., Jäger, A., Hold, P., & Sihm, W. (2016). Tangible Industry 4.0: A scenario-based approach to learning for the future of production. *Procedia CirP*, 54, pp. 13-18.
- Foster, D., White, L., Adams, J., Erdil, D. C., Hyman, H., Kurkovsky, S., Stott, L. (2018). Cloud Computing: Developing Contemporary Computer. *ITiCSE 2018 Companion: Proceedings Companion of the 23rd Annual ACM Conference on Innovation and Technology in Computer Science Education*.
- Grega, W., & Kornecki, A. J. (2015). Real-Time Cyber-Physical Systems-Transatlantic Engineering Curricula Framework. *Conference on Comp. Sc. And Inf Sys.*, pp. 755-762.
- Grevtseva, G. Y., Bashtanar, I. M., Isakova, T. I., Balikaeva, M. B., & Kirillova, Y. V. (2021). The Digital Information Competence of an Individual: Historical Aspect. *International Conference on Quality Management, Transport and Information Security, Information Technologies (IT&QM&IS)*, pp. 474-476.
- Guo, Q. (2015). Learning in Mixed Reality System in the Context of "Industrie 4.0". *Journal of Technical Education (JOTED)*, 3(2), pp. 92-115.
- Hellwig, L., Pawlowski, J., & Schäfer, M. (2020). An Innovation Activity Framework for Digital Innovation. *SIGMIS-CPR'20: Proceedings of the 2020 on Computers and People Research Conference*, pp. 10-19.
- Henseling, C., Hahn, T., & Nolting, K. (2006). *Die Fokusgruppen-Methode als Instrument in der Umwelt und Nachhaltigkeitsforschung*. Berlin: IZT.
- Hoberg, P., Krcmar, H., Oswald, G., & Welz, B. (2015). Skills for Digital Transformation. *TUM*.
- Holtel, S., Kowalczyk, M., & Paegle, L. (2020). Beating Paths Through the Digital Jungle: How Companies Master Digital Culture Change. *Proceedings of the European Conference on Pattern Languages of Programs 2020 Article No.: 22*, pp. 1-11.
- Hummert, H., Traum, A., Görs, P. K., & Nerdinger, F. W. (2019). *Wirkung der Digitalisierung von Arbeit auf Mitarbeiter/innen in Dienstleistungsunternehmen*. Universität Rostock: Seniorprofessur für Wirtschafts- und Organisationspsychologie.
- Iilomäki, 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), pp. 655-679.
- Kiesel, M., & Wolpers, M. (2015). Educational challenges for employees in project-based Industry 4.0 scenarios. *i-*

- KNOW '15: Proceedings of the 15th International Conference on Knowledge Technologies and Data-driven Business, Article No.: 41*, pp. 1-4.
- Kitchenham, B., Brereton, O. P., Budgen, D., Turner, M., Bailey, J., & Linkman, S. (2009). Systematic literature reviews in software engineering- a systematic literature review. *Information and software technology, 51(1)*, pp. 7-15.
- Knorr, J. (2020). Digital Mindset zur Steigerung der Wettbewerbsfähigkeit. In M. H. Dahm, & S. Thode, *Digitale Transformation in der Unternehmenspraxis* (pp. 45-59). Wiesbaden: Springer Fachmedien.
- Lipmann, V. (2020, 11 12). *Practical Tips to Help Companies Develop A Digital Mindset*. Retrieved from <https://www.forbes.com/sites/victorlipman/2017/07/19/practical-tips-to-help-companies-develop-a-digital-mindset/?sh=75405c577fe5>
- Mitra, A., O'Regan, N., & Sarpong, D. (2018). Cloud resource adaptation: A resource based perspective on value creation for corporate growth. *Technological Forecasting and Social Change 130*, pp. 28-38.
- Mulder, M. (2014). Conceptions of professional competence. In M. Mulder, *International handbook of research in professional and practice-based learning* (pp. 107-137). Dordrecht: Springer.
- Murawski, M., Bühler, J., Blatz, K. C., & Bick, M. (2019). Comparing the required competencies of sales professionals servicing digital and physical channels of sale: a case study of a German children's entertainment company. *Fortieth International Conference on Information Systems*, pp. 1-9.
- Müller, S. D., Obwegeser, N., Glud, J. V., & Johildarson, G. (2019). Digital Innovation and Organizational Culture: The Case of a Danish Media Company. *Scandinavian Journal of Information Systems: Vol. 31: Iss. 2, Article 1*, pp. 3-34.
- Okoli, C., Schabram, K. (2010). "A Guide to Conducting a Systematic Literature Review of Information Systems Research.". *Sprouts: Working Papers on Information Systems*, 10(26).
- Osmundsen, K. S. (2020). Competences for Digital Transformation: Insights from the Norwegian Energy Sector. *Proceedings of the 53rd Hawaii International Conference on System Sciences*, pp. 4326-4335.
- Osmundsen, K., Iden, J., & Bygstad, B. (2018). Digital Transformation: Drivers, Success Factors, and Implications. *MCIS 2018 Proceedings, Corfu, Greece*.
- Pawlowski, J. M., & Holtkamp, P. (2012). Towards an internationalization of the information systems curriculum. In MKWI 2012-Multiconference Business Information Systems(pp. 437-449).
- Petter, S., Barber, C. S., Barber, D., & Berkley, R. A. (2018). Using Online Gaming Experience to Expand the Digital Workforce Talent Pool. *MIS Quarterly Executive*, pp. 315-332.
- Plumanns, L., Janssen, D., Vossen, R., & Isenhardt, I. (2019). Organizational and Individual actors for Training of the Manufacturing Workforce in Digitalization. *2019 IEEE Global Engineering Education Conference (EDUCON)*, pp. 1158-1166.
- Prifti, L., Knigge, M., Kienegger, H., & Krcmar, H. (2017). *A Competency Model for "Industrie 4.0" Employees*. St. Gallen: 13. Internationaler Tagung Wirtschaftsinformatik (WI2017).
- Punie, Y. (2007). Learning Spaces: an ICT- enabled model of future learning in the Knowledge- based Society. *European Journal of Education, 42*, pp. 185-199.
- Reis, J., Amorim, M., Melao, N., & Matos, P. (2018). Digital transformation: a literature review and guidelines for future research. *Systems and Technologies* (pp. 411-421). Cham: Springer
- Salleh, L. M. (2008). Communication competence: A Malaysian perspective. *Pacific and Asian Communication Association 11(3)*, pp. 303-312.
- Schulz, M., Mack, B., & Renn, O. (2012). *Fokusgruppen in der empirischen Sozialwissenschaft: Von der Konzeption bis zur Auswertung*. Springer.
- Schwertner, K. (2017). Digital Transformation of business. *Trakia Journal of Sciences, 15(1)*, pp. 388-393.
- Sebastian, I. M., Ross, J. W., Beath, C., Mocker, M., Moloney, K., & Fonstad, N. O. (2017). How Big Old Companies Navigate Digital Transformation. *MIS Quarterly Executive, 16(3)*, pp. 197-213.
- Shahlaei, C., Rangraz, C., & Stenmark, D. (2017). Transformation of Competence - the Effects of Digitalization on Communication's Work. *ECIS 2017 Proceedings*, pp. 195-209.
- Singh, A., & Hess, T. (2017). How Chief Digital Officers Promote the Digital Transformation of their Companies. *MIS Quarterly Executive: Vol. 16: Iss. 1, Article 5*, pp. 1-17.
- Smit, J., Kreutzer, S., Möller, C., & Carlberg, C. (2016). *Industry4.0 Report*. European Parliament.
- Solberg, E., Traavik, L. E., & Wong, S. I. (2020). Digital Mindsets: Recognizing and Leveraging Individual Beliefs for Digital Transformation. *California Management Review*.
- Sousa, M. J., & Wilks, D. (2018). Sustainable Skills for the World of Work in the Digital Age. *Systems Research and Behavioral Science, Syst. Res 3*, pp. 399-405.
- Tahvanainen, S., & Luoma, E. (2018). Examining the Competencies of the Chief Digital Officer. *Twenty-fourth Americas Conference on Information Systems*, pp. 1-10.
- Vial, G. (2019). Understanding digital transformation: A review and a research agenda. *Journal of Strategic Information Systems*.
- Von Ohain, B. P. (2019). Leader Attributes for Successful Digital Transformation. *Fortieth International Conference on Information Systems, Munich 2019*, pp. 1-17.
- Weber, B., & Butschan, J. (2017). Tackling hurdles to digital transformation – The role of competencies for successful IIoT implementation. *2017 IEEE Technology & Engineering Management Conference (TEMSCON)*, pp. 312-317.
- Webster, J., & Watson, R. T. (2002). Analyzing the past to prepare for the future Writing a literature review. *MIS quarterly*, pp. xii-xxiii.
- Zagimnyak, M., Mamchur, D., & Gladyr, A. (2020). Digital Competences Enhancement for Electromechanics Specialists: dComFra Approach. *2020 IEEE Problems of Automated Electrodrive. Theory and Practice (PAEP)*, pp. 1-4.