Research Report:

Identifying Skills Needs
for Green Digital Transformation
Management

Version 2.o

2020-1-TR01-KA226-HE-098393

Building Virtual Learning Platform for Environmentally-Friendly Digital Transformation Management

RESEARCH REPORT

IDENTIFYING SKILLS NEEDS FOR GREEN DIGITAL TRANSFORMATION MANAGEMENT

With a general definition, digitalization is expressed as the transformation of business processes into a digital format for businesses, institutions, and individuals. This concept, often used interchangeably with digital transformation, involves digitizing all departments such as human resources, marketing, production, and supply chain. The concept of "digital transformation," referred to by different names such as Industry 4.0, 4th Industrial Revolution, and Industry 4.0 in the literature, began with the use of production processes based on cyber-physical systems (Kagermann et al., 2013). This new process connects human, digital, virtual, and other physical systems and regulates their relationships through cyber-physical systems, sensors, and actuators (Gorecky et al., 2014:12), and is often referred to as the new revolution of the industry.

Digital transformation is not limited to the use of specific technologies by companies, but also encompasses their ability to successfully adapt and utilize new technologies and business processes (Herbert, 2017). As such, digital transformation emphasizes the "human" element involved in using digital technologies and the importance of adapting to new skills and tools. The concept of digital transformation requires a more complex approach due to its broad scope. Recently, the concept of "green digital transformation" has gained importance with the European Commission's establishment of a "green Europe target suitable for the digital age." According to the European Digital SME Alliance, this concept refers to an industry that uses digital technologies to save resources, increase efficiency, and promote the repairability and reuse of products. Two key skills that stand out in the concept of green digital transformation are digital skills and green skills.

According to the definition of the United Nations Industrial Development Organization (UNIDO), green skills, with its most general definition, refer to the knowledge, skills, values and attitudes required to live, develop and support a sustainable and resource-efficient society. This concept, which is seen as a key for the future of Europe together with digital skills, is accepted as the ability to perform environmentally friendly business and transactions in its most general definition. The goals of creating a green and digital single market for the "future of Europe"; are the transformation policies that have come to the fore recently. Accordingly, it is known that the EU will update existing laws and take new measures during the next ten years, emphasizing that green and digital transition are a simultaneous priority.

Accordingly, while ensuring that data centers are climate neutral, energy efficient and sustainable by 2030 at the latest, another example is that it will be possible to reduce energy efficiency by 90% on a global scale with the transition to 5G technology instead of 4G technology (European Commission, 2022). Accordingly, it is seen that supporting environmental policies with digital solutions can positively affect climate change at the global level. The use of digital technologies, which is a lever of environmental recovery and green transition, is one of the priority areas for both businesses and governments in this sense. It is also remarkable that digitalization reduces the costs of the industry by providing better energy and resource use. For example, in the UK, it has been stated that the use of digital technology to increase resource efficiency in businesses will add £38 billion to the profitability of the construction industries by 2027 (Green Alliance, 2021). Also, Digitally enabled energy efficiency could save UK businesses £6 billion a year by 2030 (Green Alliance, 2020). In line with these examples, according to the statement

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published by the European Green Digital Coalition, "3" priorities have been determined in order to accelerate the green digital transformation. These:

> • *Invest in the development and implementation of green digital solutions with significant energy and material efficiency that have a net positive impact across a wide range of industries.*

> • *Develop methods and tools, in collaboration with NGOs and relevant specialist organizations, to measure the net impact of green digital technologies on the environment and climate.*

> • *Create proposals and guidelines, in partnership with representatives from other sectors, for the green digital transformation of these sectors to benefit the environment, society, and economy.*

According to UNIDO, the transition to a low-carbon, resource-efficient economy requires systemic changes, not only in new products and services, but also in production processes and business models. This greening of the economy will inevitably change the skills required and the tasks involved in many of the current occupations. In this context, it will be inevitable that both new job-task definitions and new skills will emerge. According to the "*European Skills Agenda for Sustainable Competitiveness, Social Justice and Resilience*" prepared by the European Commission, it is necessary to increase the number of professionals who will accelerate the green transition for the jobs of the future, develop and master green technologies, including digital, and develop green products, services and business models. In addition, the number of professionals who will be innovative, create nature-based solutions and help minimize the environmental footprint of activities should be increased, and to do so requires investment in people's skills. One of the profiles that emerge when companies adapt to these new digital and green business models is digital transformation experts/managers. In this project, it is aimed to bring individuals who will take part in the "managerial" dimension of digital transformation and who will facilitate the "digitalization" of enterprises to the labor market in line with the European Qualifications Framework. The mentioned competency framework will focus on green skills, and a target will be pursued to bring the idea of environmentally friendly digital transformation management. As a matter of fact, according to UNIDO, many existing professions and industries mentioned that they will experience "environmental changes" in their job duties and that these professions will require adjustments in their existing education and qualification frameworks.
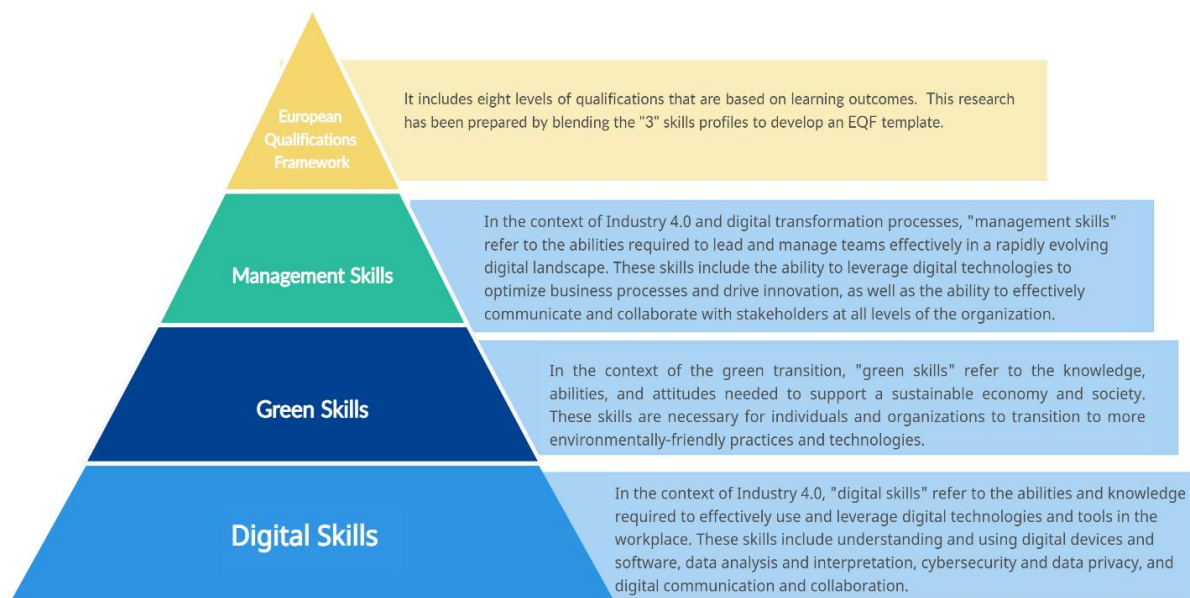

Figure 1. EQF Structure for Green Digital Transformation (by Authors)

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This report is organized around green skills, digital skills, and management skills, as shown in Figure 1. By exploring the intersection of these three profiles, insights into the skills of 'green digital transformation managers' were obtained. The research report is based on focus group discussions, interviews, surveys, and analyses of job advertisements in Türkiye, UK, and Germany, resulting in a comprehensive benchmarking report.

Digital transformation is accepted as the driving force of economic development and growth by increasing speed and efficiency in businesses with the tools and business processes it uses. As in the whole world, this situation has brought the concept of digital transformation to the forefront for the European Union. The European Union, where inclusive growth is targeted, has not only targeted an infrastructure development in accelerating digital transformation, but has considered individuals' digital skills a must in this process. On the other hand, according to Eurostat data, the average of digital skills in the EU is 56%, and it has been observed that the digital skill levels of the countries in the list are quite different from each other. This situation points to an important problem in improving the digital skills of individuals in the EU. DigiComp 2.0, which focuses on the digital competencies of citizens in the EU, has defined the digital competencies field in a holistic way accordingly. In this process, topics such as information and data literacy, communication and cooperation, digital content creation, security, and problem solving come to the fore. DigiComp, first published by the European Commission in 2013, establishes a common European-level framework on how to identify and define the key areas of digital competence (DigiComp2.0, 2016).

The digital skills covered in this report focus on high-level skills at levels 6-7 of the EQF. Digital skills are combined with " management" skills, thus aiming to provide a projection that will define the skill needs of businesses in Europe, especially SMEs, in the field of digital transformation management. According to the Digital Europe report, it is stated that digital companies grow on average two and a half times faster than non-digital companies, so the expenditures that enable the adoption of digital competition within the EU budget will increase the competitiveness of the EU. It has been stated that especially the internet of things (IoT) and data sharing, artificial intelligence, 5G and digital infrastructures are among the digital tools related to this competition. Indeed, a study by the McKinsey Global Institute has shown that sectors such as manufacturing, mining, healthcare and education could add €2.5 trillion to EU GDP if they doubled their use of digital assets and increased the digitization of labor.

It has been stated that digital tools will have great effects on the socio-economic structure of Europe. Accordingly, it has been stated that advanced robotic technologies, 3D printers will lead to growth and restructuring in industrial sectors, especially in supply chains. It has been stated that these new industrial processes and materials will also lead to more sustainable products and will make significant contributions to Europe's green transformation. The increasing impact of digital technologies in the economic structure of the European Union has affected the production processes, organizational structures and administrative areas of the labor markets. However, despite the importance in question, it has been observed that the digital skills of individuals in EU countries are still not at a sufficient level. Indeed, according to the European Digital Strategy, 42% of European citizens do not have basic digital skills; 37% of diverse workforce profiles such as farmers, bank workers and factory workers lack adequate digital skills despite their growing digital skills needs. For this reason, the European Coalition for Digital Jobs and Skills has classified the digital skills it targets into 4 groups. These groups are:

> • *Digital skills for all: Developing digital skills to enable all citizens in Europe to be active in the digital society,*
> • *Digital skills for the workforce: Developing digital skills for the digital economy, eg. actions on upskilling and re-skilling of workers and job seekers, and career advice and guidance*
> • *Digital skills for ICT professionals: Developing high-level digital skills for ICT professionals in all industry sectors*
> • *Digital skills in education: Transforming the teaching and learning of digital skills in a lifelong learning perspective, including teacher training.*

In line with these four goals, the coalition encourages the use of available funds to support digital skills and raise awareness of the importance of digital skills to employability, competitiveness and inclusion in society. It has been considered important to ensure that young people are employed in line with vacant jobs by educating them digitally through the training programs provided with these incentives. It has been emphasized that these digital skills will also meet the workforce needs of SMEs and support their competitiveness.

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The European Investment Bank also mentioned in its report that digital technologies promote the green transition. Accordingly, 69% of digital companies in the European Union made investments in the field of energy efficiency, and in the EU, about 32% of digital-intensive companies stated that they made investments to combat air pollution and reduce carbon emissions, thus fighting against climate change. In addition, although the relevant data lag behind the USA, it is stated that the digitalization intensity and the investment balance against climate change are at a better level in Europe. According to the findings of a study conducted within the scope of the Future Jobs Report of the World Economic Forum (WEF), digital transformation instruments, especially cloud technology, big data, energy providing technologies and the internet of things, will be the driving force of change for businesses in different sectors.

It has been seen that the targeted change with these tools is primarily responding to the changing business life and flexibility needs (44%), adapting to emerging markets (23%), transition to green economy and climate change (23%). In this research, similar instruments were listed and it was questioned which technologies were found important by the enterprises, and the digital transformation motivations of these enterprises were listed. As can be seen in the relevant section where the key findings are listed, it is noteworthy that the cumulative findings of Turkey, England and Germany are distributed under similar headings. In addition to all these research and objectives, skill gaps and job-skill mismatches are striking in Europe. Many people in European countries work in jobs that do not match their abilities. In addition, 40% of European employers struggle to find people with the skills they need to grow and innovate. According to the European Digital Strategy, more than 70% of businesses consider the lack of staff with sufficient digital skills to be a barrier to investment. A strong digital economy supported by digitally-skilled Europeans is vital to innovation, growth, employment and European competitiveness. Accordingly, it is emphasized that the business world, education providers, the European Commission and other organizations should work together to fill the digital skills gap. However, with the digital transformation becoming effective all over the world, opportunities such as efficiency, competitiveness and growth have gained importance for both businesses and governments. Since digital transformation is related to following the innovation and revealing it, there is an absolute need for a new workforce in this field, they can be called Digital Transformation Managers. As a matter of fact, one of the objectives defined in the European Skills Agenda is stated as follows;

> **i**
>
> *"Design and delivery of master courses to train digital experts in advanced digital skills necessary for the digital transformation and master courses to train experts in green skills for the green economy"*

In this project, it is aimed to bring professionals who have mastered the "green digital transformation" process to the labor market by matching the two master program objectives in a single master level module. Accordingly, prominent competency demands were examined for the development of an innovative module covering all digital skills, green skills and management skills. In the aforementioned review, the opinions and suggestions of representatives from academia and business world were taken in each process and combined in this text, which is the final report. Thus, it is aimed that the curriculum to be designed will include the demands of the business world and bring together multiple skills.

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METHODOLOGY

This study, which aims to prepare a graduate level curriculum module in the field of digital transformation management, was prepared in cooperation with the university-business world. Thus, it is aimed to integrate the expectations and demands of the labor market in the relevant field with the module to be developed. With this integration, it has been tried to prevent the gaps in the statistics of job-skills mismatch in the European Union member and partner countries. In each phase of the research, opinions and suggestions of professionals working in different departments and related to digital transformation were received. These views and suggestions were combined with the descriptive analysis method of current academic studies, field studies, reports and bulletins in the relevant field. Thus, the university-business world cooperation process, which also constitutes the main structure of the project, was also reflected in the questionnaire. In this context, qualitative and quantitative research data collection methods were used together between July 2021 to November 2021 in the project partner countries. The research process was carried out in 4 phases and the European Qualifications Framework (EQF) was created based on the cumulative data set to realize a common module at EU level. It was based on levels 7 and 8 of the European Qualifications Framework, as the project focused on the development of curriculum at postgraduate level. Framework is as follows;
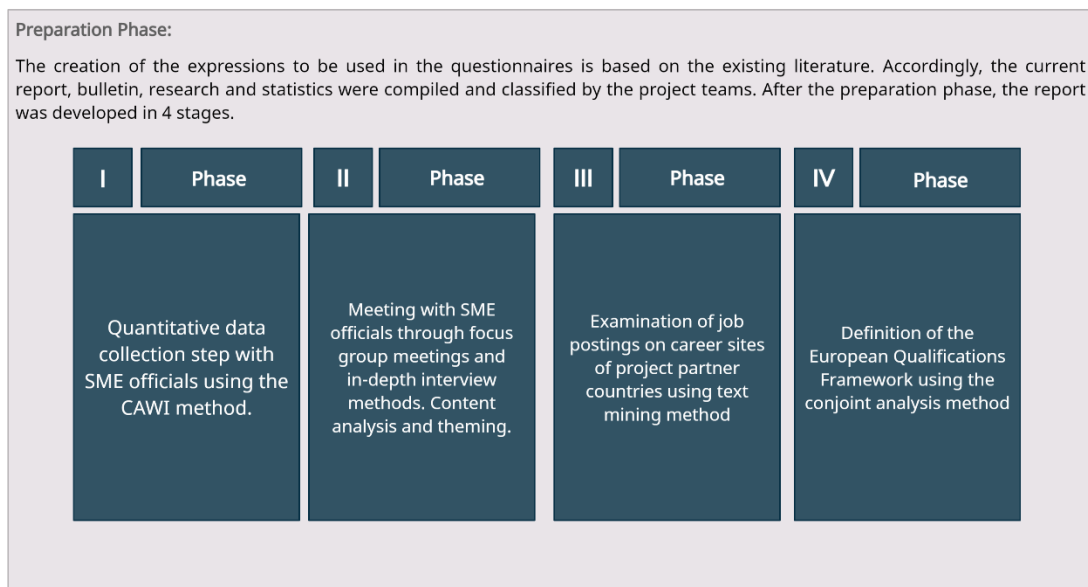

Preparation Phase:

The creation of the expressions to be used in the questionnaires is based on the existing literature. Accordingly, the current report, bulletin, research and statistics were compiled and classified by the project teams. After the preparation phase, the report was developed in 4 stages.

I Phase	II Phase	III Phase	IV Phase
Quantitative data collection step with SME officials using the CAWI method.	Meeting with SME officials through focus group meetings and in-depth interview methods. Content analysis and theming.	Examination of job postings on career sites of project partner countries using text mining method	Definition of the European Qualifications Framework using the conjoint analysis method

Figure 2. Report Workflow Diagram (by Authors)

The questionnaire used in the first phase of the research was prepared in three different languages, Turkish, English and German, by taking the opinions and suggestions of all partners. The relevant survey was delivered to SMEs by the project partners using the internet-based survey method (CAWI). This questionnaire form consists of 16 questions in total, including single choice, multiple choice and open-ended answers. The questionnaire started with descriptive statistical questions such as NACE code classification, business scale, and participant's job description, which aimed to determine the profile structure of the participating businesses. Thus, the current situation, trends and demands in the field of digital transformation management in different sectors could be compared. It was ensured that the research was delivered to different companies both in the manufacturing industry and in the services sector such as chemistry, finance, machinery manufacturing, automotive and insurance. Thus, it is aimed to define the 'most common digital transformation management' skills needs of the business world.

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The questionnaire continued by examining the current levels of enterprises in the field of digital transformation, their past activities, the status of having a strategy in the field of digital transformation and their motivations. In the questionnaire, sequential questions were directed to the participants to define the skills under a total of 3 titles. These titles are Digital Skills, Management Skills and Green Skills. The statements in the questionnaire were arranged randomly in order to prevent a possible deviation and wereprepared by applying a maximum of 4 selection quotas. Thus, it has been ensured that the enterprises can choose the relevant skill needs in a limited way, and the priority needs of the relevant enterprises can be determined.

> **i**
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> **Digital Skills:** A total of 11 digital transformation instruments such as artificial intelligence, 3d printers, ERP systems and autonomous robots are listed among digital skills. In addition, the answers that the participants wanted to specify were open-ended, except for the digital tools listed by opening the "other" tab. In this way, it was ensured that the participants could include the other answers in the order by content analysis and coding method. The aforementioned question phrase also deepened specific areas such as cyber security, data science, user interface design, which are expressed as "hard skills" and express higher-level digital skills, in the next question.
>
> **Management Skills:** Administrative skills were the second targeted topic since the project deals with the" management" side of the digital transformation. Accordingly, the skills that may be required in the field of digital transformation management are listed using the desk research method. Accordingly, 14 different skills such as digital maturity measurement, strategy plan preparation, change management and agile methodology (agile) are listed. Again, by opening the "other" answers other than the listed skills could be obtained. The related question statement also listed titles such as digital leadership, digitalization culture, belief and mentality in digitalization, since the "management" process of digital transformation is also related to the normative structure of the workplace. Thus, it has been understood which topics are preferred/prioritized in terms of how to manage possible "esistances" in the field of digital transformation management in businesses.The purpose of putting the question statement in question is the consensus in the preliminary researches and interviews that the resistance of the personnel or senior management in the enterprises to digital transformation is one of the biggest obstacles to digital transformation. In this context, determining the skills that will be required in order to properly manage thepersonnel resistance, especially in the departments, constituted the purpose of this question statement.
>
> **Green Skills:** Since the digital transformation management curriculum targeted by the project has the added value of "environmentally friendly", the third topic is about green skills. Accordingly, in the current research and publications, especially in the field of digital transformation, necessary green skill titles were determined and included in the ranking. Since green skills are a relatively new skill area, the definition and scope of each listed green skill is briefly stated. Accordingly, 10 different green skills were listed and the other tab was opened, allowing the participants to write the external answers.

Except for the relevant main questions, the digitalization projects and motivations of the enterprises in the past were taken as open-ended answers. In addition, in the transformation process of companies with any digital transformation history, their outsourcing (training, consultancy, leasing, etc.) was examined. Thus, the current situation of the skill barrier in the digital transformation process was partially understood. The answers obtained were collected in the cumulative data set and analyzed using the SPSS package program. Percent-frequency analysis was preferred due to the creation of descriptive statistical expressions. Key findings were presented to the reader by visualizing the responses.

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I.   Digital Skills

In its most general definition, digital competencies refer to the ability of individuals to effectively use information and communication technologies (ICT) and digital tools for purposes such as fulfilling work-related and daily life tasks and solving problems. Digital skills, which are expressed as the basic skills of the 21st century, have been included in the European Digital Strategy as one of the main focus areas of the European Union. This title, which is one of the elements of strengthening Europe';s digital economy, has been taken as an important development area because the "skill gap" problem directly affects and/or affects other socio-economic indicators of societies.

Digital skills vary at different maturity levels and across industry applications. In this research, the subject of digital skills was examined in order to realize the "digital transformation" in the business world. In a study on digital competencies, skills such as evaluating data and digital content, searching and filtering data and information, interaction through digital technologies, data management and collaboration through digital technologies are stated respectively (Vuorikari et al. 2016: 8). In another study examining the competence needs for digital transformation in workplaces, it was found as the processing and analysis of data and the use of digital technologies. (Fonseca and Picota, 2020). Accordingly, it can be said that there is an important dominant view on "processing and management of data" regarding digital skills.

Accordingly, in this study, which aims to have knowledge about the purposes of use of digital transformation instruments and even to use them, it is aimed to facilitate the "management of digital transformation" by strengthening the "literacy" skills for the relevant digital technologies. Digital literacy is defined as the awareness, attitude and ability of individuals to use digital tools and opportunities appropriately to identify, access, manage, integrate, evaluate, analyze and synthesize digital resources, create new information, create media expressions and communicate with others in context. Martin, 2006). With the findings to be obtained through research questions in this area, it is aimed to develop "literacy" for digital tools that will come to the fore in the field of Industry 4.0. Two question statements are presented to understand the prominent technologies for this literacy.

The first of these statements *is "Which of the following new technology skills do you think are primarily necessary for digital transformation in your business*?" is a question statement. The other is "*Which of the new digital skills listed below are primarily necessary for your digital transformation needs in your business*?" is a question statement. As a result of these question statements addressed to the participants, the priority Industry 4.0 tools needed by these enterprises in the digital transformation process were defined and the potential needs of the business world in the digital transformation process were understood. This situation also provided the definition of the potential digital skills demanded by businesses and revealed which topics the professionals who will work in the field of digital transformation management should potentially have knowledge on.

> Which of the following new technology skills do you think are primarily necessary for digital transformation in your business*?*
>
> Which of the new digital skills listed below are primarily necessary for your digital transformation needs in your business

II.   Management Skills

Management skills are "behavioral" skills under the control of the individual and can be defined as actions performed by individuals that lead to certain results. The fact that digital transformation is a process in businesses has increased the studies examining the qualifications of the people who will manage and lead this transformation. When the behavioral profiles of effective managers are examined, it was stated that they had a set of skills such as managing time and stress, managing individual decisions, identifying and solving problems, motivating and directing others, empowerment, goal setting and vision creation, self-awareness and teamwork skills. (Whtten and Cameron, 2011:9). Since digital transformation is a complex field, it is important to direct this transformation correctly. This brings to mind the concept of management skills and raises questions about what management skills the professionals who will take part in the realization of a successful digital transformation in businesses should have. Research has been conducted on the skills needed to successfully manage digital transformation. These studies have revealed that skills are needed such as communication, emotional intelligence, empathy, leadership, motivation, conflict resolution, professionalism, resilience and negotiation ability, critical thinking, complex communication, collaboration with creativity, flexibility and adaptability, productivity and accountability, developing a team building, developing a growth mindset, influence,the ability to navigate innovation and change, effective collaboration with leaders and between teams. (Piccinini et al., 2015; Gulati and Reaiche, 2020:42).

When the operational skills specific to digital transformation are examined, it is seen that the titles such as strategy management, process management and corporate management come to the fore. For organizational exce lence, topics such as change management, cooperation management, knowledge management, leadership management and corporate culture are discussed. (Peter et al.,2019:7). In this study, it is aimed to understand the management skills that businesses specify in the digital transformation process in line with the determination of management skills that will support digital skills.

III.   Green Skills

Green skills, which define a new skill class, refer to a skill area for which a common definition has not yet been made. In the most general definition, these skills can be defined as the skills to realize environmentally friendly product and service processes. Considering the recent actions in which the goal of a greener Europe was determined, it came to the fore with various policies. As a matter of fact, in the last few years, when carbon tax regulation at the border began to guide production relations and trade relations, the issue of green skills has started to become not only "social responsibility' and 'organizational value' but 'obligation' for many disciplines. Jobs in which greenskills are actively used are referred as "green job". Accordingly, works such as the installation of solar panels, bio-fuel and hybrid vehicle production, organic agriculture, insulation, and the construction of giant wind turbines, which provide to improve the environmental quality and protect the eco-system from harm in low-carbon and sustainable economies, are also called green jobs (Özsoy, 2007). 2011:19). According to the Global Green Skills Report 2022, green skills have increased significantly in different occupational profiles over the past few years. According to the related report, the first of the five fastest growing green jobs was the Sustainability Manager (30%). This was followed by Wind Turbine Technician (24%), Solar Consultant (23%), Ecologist (22%) and Environmental Health and Safety Specialist (20%). In this context, increasing "green practices"in many sectors, especially in the manufacturing industry, will accelerate the employment of personnel with relevant job descriptions.

PHASE I: QUANTITATIVE FINDINGS

Questionnaire method, which is a quantitative research method, was used in the first phase of the field research. The current situation, skill needs and future plans of SMEs in the field of digital transformation management were defined with descriptive statistical indicators, with the survey study conducted using the Cawi method in businesses. Randomly ordered quantitative question statements were used to understand the current situation analysis of SMEs in different sectors. Thus, it was aimed to understand different topics, such as the digitalization history of businesses, digitalization plan, priority technologies they need in digital transformation, digital skills, green skills and management skills. These indicators, which were in the nature of current situation analysis, presented to the reader for reference in designing the content of the targeted curriculum and modules.

Figure 3. Sample Survey Screen

In order to understand the past digitalization adventures of businesses, *"Have you carried out any activities in the field of digital transformation in the last three years*?" statement was directed. It was observed that 53.4% of the participants gave a predominantly "No" answer to the related question statement. It has been observed that the rate of enterprises that have engaged in any digital transformation activities in the last 3 years is 33,6%
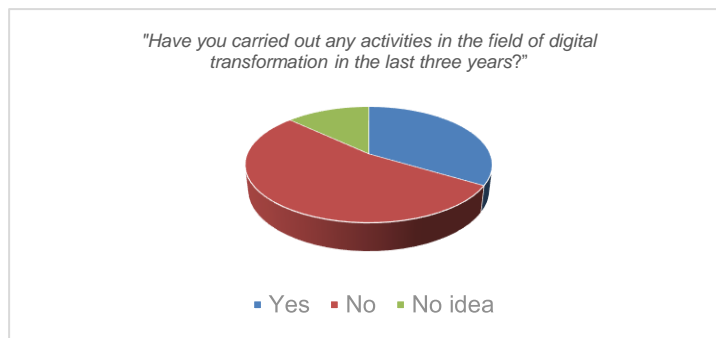
In the last 3 years, the activities of 33% of businesses that have been operating towards digitalization were questioned with the help of open-ended questions. The answers received by the query were transferred to the database by content analysis and coding method, and the frequency values were obtained. It has been observed that businesses with digitalization activities have turned to digital marketing activities, which have increased in importance in the Covid-19 process. It has been observed that this is followed by the use of cloud technology and the transition and update studies to ERP systems, which is considered one of the most important horizontal-vertical software integrations.
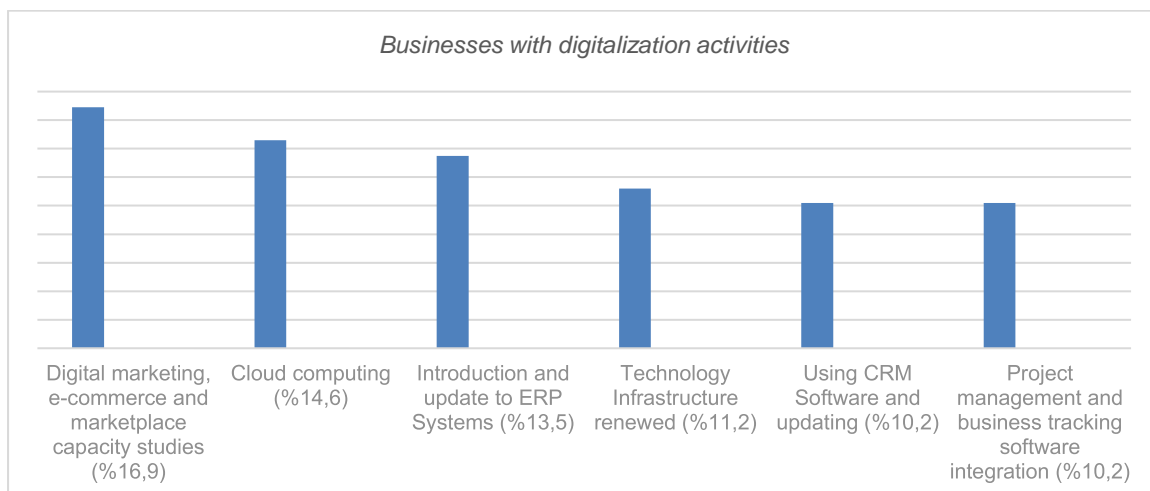
- ***Digital Transformation Instruments***

In order to understand the trends of businesses towards digital transformation, *"Does your business have a digital transformation plan for the next "5" years*?" question was asked. More than 65% of businesses stated that they want to realize digital transformation within the next 5 years. It has been observed that 34.7% of them are companies that resist digital transformation.

Industry 4.0 tools, which are prioritized in the digital transformation processes of SMEs operating in manufacturing industry enterprises such as metal manufacturing, food, chemistry, electricity and energy, and service sectors such as finance, education, consultancy and marketing in Türkiye, Germany and UK came to the fore.

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Businesses with digitalization activities
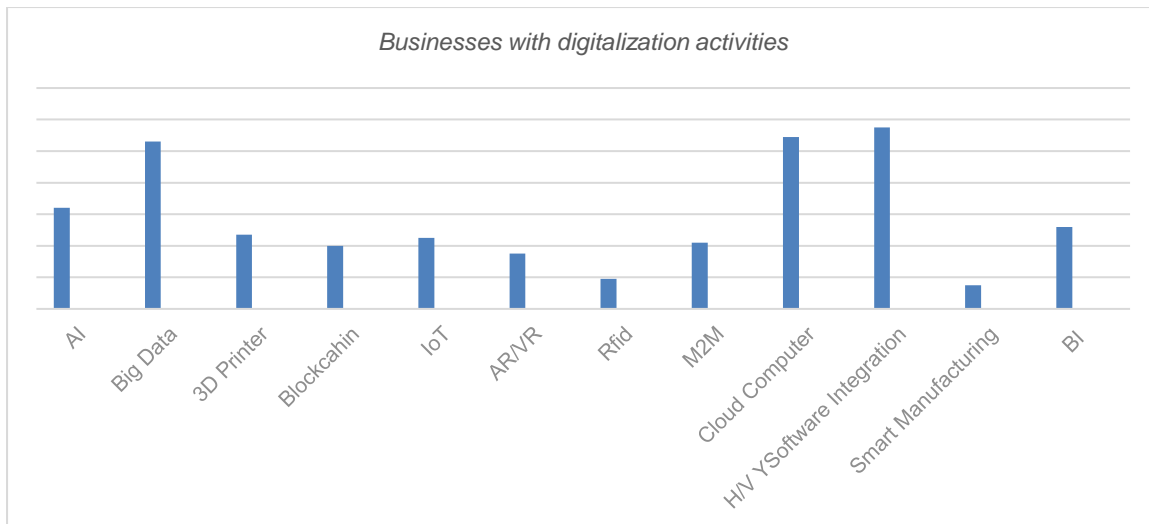
In the answers given to the question statement about this field, it was revealed that businesses primarily find ERP solutions, which are one of the horizontal and vertical software integration technologies, necessary for the digital transformation of their businesses. The related statement was followed by cloud technology and big data analytics technology. In this process, it has been seen that the technology that is stated to be the least needed is smart production systems and radio frequency identification (rfid) technology.

Definitions of digital technologies used in the survey	
HORIZONTAL-VERTICAL SOFTWARE INTEGRATION	Horizontal integration is the name of the communication established by connecting the external stakeholders (suppliers, transportation, finance, etc.) in the ecosystem outside the enterprise, with the software infrastructure of all departments such as human resources, marketing, finance and production within the enterprise. Horizontal integration is the name of the communication established by connecting with the external stakeholders in the ecosystem outside the enterprise, and the software infrastructure of all departments within the enterprise, such as human resources, marketing, finance and production.
3D PRINTERS	3D printers, called additive manufacturing technology, is the process of printing three-dimensional virtual products designed in a computer environment in solid form by means of special printers. The working principle of these printers, which can prepare copies of products designed with the use of various materials such as plastic, metal, glass, ceramics, is by printing three-dimensional drawings prepared in computer environment by adding them in layers. This technology, which increases resource efficiency especially in the manufacturing industry, is considered one of the priority tools for eco-production.
CLOUD COMPUTING	"Self-configurable 21 is a model that allows access to a common pool of information resources at any time, from anywhere, under favourable conditions and on demand. These resources (computer networks, servers, databases, applications, services, etc.) are defined as systems that can be easily procured and disposed of, with minimal administrative effort and interaction between service recipients and service providers".
AR & VR	Augmented Reality and Virtual Reality, in the most general definitions, is a technology product that captures virtual information and enables it to be experienced using visual tools such as graphics, images or video through various devices, and is a method used by companies to test integration by implementing business applications as pilot projects.
Internet of Things (IoT)	The internet of things is defined as a communication network in which every physical object, animate or inanimate, is linked to data networks (Erturan & Ergin, 2017). In this context, the Internet of Things is a system that provides information transfer between physical objects and provides an infrastructure for devices to talk to each other. For this reason, this concept stands out as the basic element of interoperability, which is one of the keys to the new digital transformation.
BIG DATA ANALYTICS	It is defined as data that provides a continuous flow of information greater than 100 terabytes, and provides a perfect resource for data mining used in decision making and measurement evaluation mechanisms.

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ARTIFICIAL INTELLIGENCE	It is an artificial operating system specific to human intelligence, which is expected to exhibit higher cognitive functions or autonomous behaviors such as perception, learning, connecting plural concepts, thinking, reasoning, problem solving, communication, inference and decision making.
M2M	It is an information and communication technology tool that enables the interaction of human (user) and machines from distant points between chemical, biological systems and processes, by bringing together communication, computer and power technologies.
SMART Manufacturing	They are new generation digital factories equipped with high-level data and technology usage infrastructure that enables to increase efficiency in smart production factory infrastructures, to monitor production instantly and to intervene remotely.
BLOCKCHAIN	It is a distributed database of all transactions or digital events that are carried out and shared between the participating parties, and it is a digital economy tool that enables the public to promote, share and conduct transactions over shared data/resources.

- ***Digital Transformation Motivations of Businesses***

Digital transformation provides many benefits such as advanced data collection in businesses, gaining data-based consumer insight and thus improving consumer-based competition in the market, strong resource management, customer experience, agility and productivity increase.In order to determine the motivating factors for these plans of the enterprises that plan to realize digital transformation in the next five years, the following statement has been directed. "*In your opinion, what are the current motivations for your business to achieve digital transformation? If your business is not currently involved in any digital transformation projects, please describe possible motivations*"

In the question prepared as an open-ended statement, the digital transformation motivations of the enterprises were examined by using content analysis and coding methods. Except for the heterogeneous findings clustered in the "other" tab as a result of the content analysis, the answers were clustered under fifteen headings. Clustered responses were subjected to frequency analysis.

According to this, it was seen that the enterprises gave the answer "following the sectoral developments" (9.9%) primarily. Then, it was seen that they gave the answers of "New customer acquisition and retention"; (9.9%), "Reducing the costs" (8.5%), "Ensuring innovation" (7%) and "Increasing efficiency" (7%). When the benefits of digital transformation for businesses are examined, it has been seen that many studies have been done in the literature.As a matter of fact, businesses with high digital maturity were 62% more likely to experience strong sales growth in the last three years than their peers. (Rcgt, 2020). According to a study conducted by McKinsey, it has been observed that as consumers turn to online channels during the pandemic process, businesses also take action in this direction, and thus they take digitalization steps that will increase their sales and marketing activities in online areas 3 times more (McKinsey, 2020). Considering the interest of businesses in digital marketing and marketplaces in the last three years in the surveys conducted within the scope of this project (see: 01 digitalization history findings), it is possible to say that digitalization instruments have developed in the direction of demand all over the world.

- ***Management Skills***

Understanding the managerial skills that businesses demand from their personnel in the field of digital transformation management has been another topic of the research. Regarding this process, the necessary managerial skills in the field of digital transformation management have been researched and listed in the literature. In order to avoid a possible statistical deviation in the ranking, random ordering of the options is provided. Participants were asked to select three priority skill needs that their businesses demand in the field of digital

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transformation anagement. Apart from the listed skills, the 'other' segment was opened, allowing businesses to write their answers other than the listed options. The answers obtained were coded with content analysis and collected in theother tab. Accordingly, the following question was asked,

> ℹ️ *"Which of the organizational skills listed below do you think is primarily necessary for digital transformation in your business?"*

It has been observed that there is a need for organizational skills in the areas specified in the answers given to the relevant question. These areas are Digital Maturity measurement (12.5%) and Project Management (12.2%), Strategic Plan & Design (10.7%), Cost Management (10.4%), Risk and Time Management (7%) ,3) and Change Management (7%).

Which of the organizational skills listed below do you think is primarily necessary for digital transformation in your business?
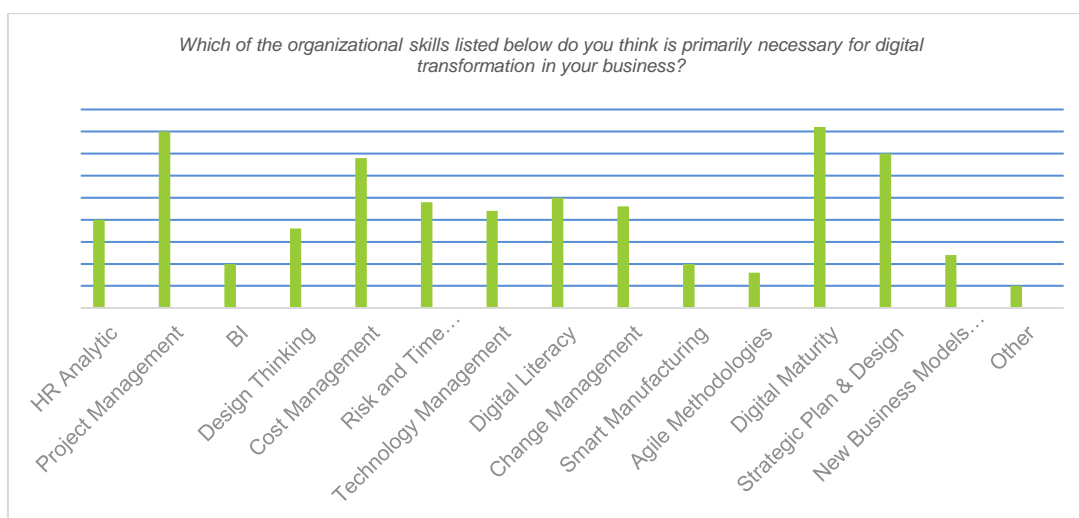
It was seen that the prominent finding in question constituted a parallel response to the literature revews. As a matter of fact, in a study examining publications in the field of change management for Industry 4.0, it was seen that international publications primarily focused on the digital maturity assessment of enterprises. It has come to the fore that many organizations provide methods and tools to examine digital readiness and assess their digital maturity status (Bellantuono, 2021:11). In this direction, learners who will be trained in the field of digital transformation management should acquire the necessary knowledge and skills in the field of digital maturity measurement. Finally, non-homogeneous skills such as the ability to conduct market research, design management, and system architecture under the other segment are clustered and included in the ranking.

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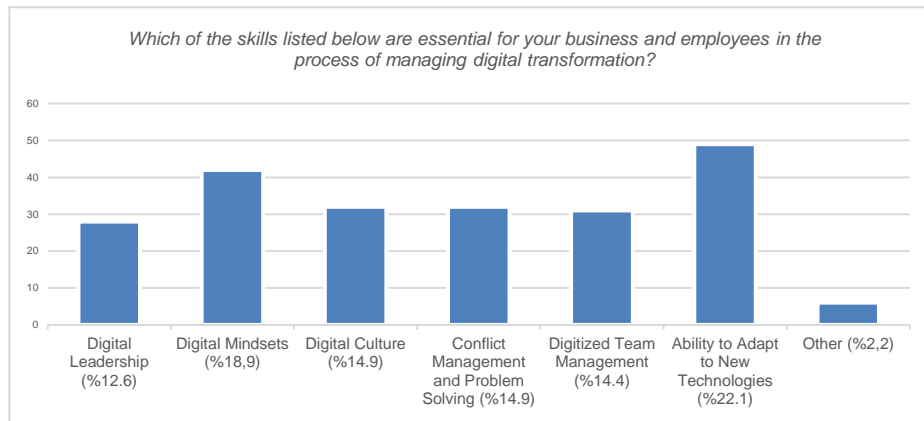
Additionally, "*Which of the skills listed below are essential for your business and employees in the process of managing digital transformation*?" statement was directed to the participants. It has been ensured that the skills, attitudes and structure required in the internal business management processes, which are expressed as soft skills for the employees, are defined. Accordingly, for the related question statement, the Ability to Adapt to New Technologies (22.2%) was taken as the answer. This response was followed by Belief and Mindset in Digitalization (19%), and Digitized Team Management (14.5). When the open-ended answers coded in the other segment are analyzed, it is seen that answers such as network mindset, high-performance team management, digital finance literacy are given.

PHASE I: QUALITATIVE FINDINGS

With Qualitative studies, the current situation, skill needs and future plans of SMEs in the field of digital transformation management were determined. Then, within the scope of the project, objectives were established to determine the contents and boundaries of the curriculum to be designed in the field of digital transformation management. In addition, a target has been set to define in depth the proposals, ideas and skill needs of SMEs in the field of digital transformation management. For this purpose, focus group interviews and in-depth interviews were conducted in Türkiye, Germany and UK in the second phase of the research. Audio and video recordings of all interviews were taken and the contents were classified, according to the question titles to be reported by the project partners.

The main objectives and themes of the focus group discussion are aimed to create a discussion that helps us to understand digital transformation, the use of new technologies and people. Through these themes, targets were set as "identifying skills needs for green digital transformation management from the perspectives of real-world operators." In line with these objectives, research questions were created in order to determine the perceptions, and attitudes of enterprises towards digital transformation, skill barriers and curriculum topics. Expert and manager profiles corresponding to the 6-7-8 levels of the European Qualifications Framework in defining skill profiles were introduced to the participants, and the deepened skills were handled within this framework.

I.   UK Findings

Within the scope of this Focus Group meeting, SME businesses from various sectors, including construction, educational technology, electronics manufacturing and education, came together.Participating businesses range from 9 to 80 employees, and all have been in operation for at least 11 years (the longest running business in the group was founded 29 years ago). The focus group interview flow meeting was generally discussed under "five" topics. These are: Understanding digital transformation, use of new technology, human resource issues, green

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skills needs, and curriculum design part. The group discussion asked participants about their "*understanding of digital transformation" and specifically "what does digital transformation mean for your business?*" A participant from the educational technologies business defined "Digital transformation for me is to look at processes and procedures in terms of both efficiency and equality". In the focus group studies and interviews, it was seen that many businesses went through a mandatory digital transformation process in the last two years due to the Corona virus. Accordingly, the pandemic and the needs and arrangements made in the working life caused by it are particularly evident in the transition to remote working and the need to use technology to replace face-to-face interactions. This is also effective for businesses that are switching to cloud-based solutions to ensure that systems are accessible to all employees. The understanding by the participants that digital transformation is a multidimensional concept and not only related to the use of technology drew attention in the research. Participants agreed that the difference between "technology use" and "digital transformation" is important. Accordingly, the participants agreed that the purchase of a new technology for the business processes of a business does not mean that digital transformation has taken place in that business.

Accordingly, the fact that only the purchase of technology by the participants did not give an adequate idea of the "digital transformation" made it necessary to consider the digitalization processes for the organization in a real sense. Accordingly, the subject of digital transformation has been accepted as a more complex field that does not only deal with technology transformation. An interesting point was made by a training provider regarding the importance of empowering their workforce to use new technologies by providing support and training in terms of relevant digital skills. Accordingly, the perception of digital transformation requires not only the use of technology and process change, but also the equipping of the "human" phenomenon, which is the most important resource of organizations, with the necessary skills. For a business, a change in business processes or the introduction of new technologies will only be successful when the workforce has the skills to embrace the change. In this context, the issue of "skill gap" in the digital transformation management process was among the important topics of the focus group meeting.

Another issue mentioned by the participants was about "starting the digital transformation". It has been stated that the digital transformation initiated by government initiatives or senior management of organizations gives the impression of a "top-down " and this situation causes a difference in motivation. For example, the government's initiation of mandatory digital transformation (allowing businesses to receive financing when necessary, etc.) sometimes means that businesses embark on a digital transformation journey even though they are not needed. Accordingly, in the digital transformation process for businesses, a digital transformation should be initiated based on a real needs analysis and where decisions are made that include not only vertical elements, but the entire enterprise. Digital transformation is much easier in this process if a company has a prescient leadership team.

Because this team can clearly articulate why the transformation will benefit the business, which encourages the wider workforce to embrace the change. From this interpretation, we can see how important the concept of digital leadership, which was also mentioned in the analysis of job postings, for businesses.

In the next stage of the focus group discussion, the participants were asked to determine the digital transformation levels of the businesses they represent. Thus, it was desired to observe, whether the perception and attitude towards digital transformation caused differentiation for different levels. An exemplary digital maturity model was shown to the participants, and maturity levels are explained by Prof. Yanqing Duan, one of the focus group moderators;

- A digital and construction firm in attendance would refer to their company and their sister company as a "4". They have an understanding of the processes; however most processes are not automated. This is through choice as they us intelligent workflows, but they do not want to remove human competency due to the nature of their work.

- A manufacturing company in attendance made an interesting comment that different departments/areas of his business are clearly at different levels on the Index. His example was that his Sales and Marketing department would be considered as a "3" on the index – they are fairly well integrated, but not fully digital. However, it would be fair to say that their Research & Development department would be considered a 5.

- A training provider stated that they would suggest that they were between 2 and 3 on the Index. They are building their own CRM and integrating this with an existing booking system. ·Interestingly the educational technology business in attendance felt that, although they help companies to improve their digital technologies, they are lacking in doing improvements themselves. They would also consider themselves to be between a 2 and 3.

Source: https://digitopia.co/digital-maturity-explained-operations-rebooted/

Following the maturity models questions, some other questions were asked to understand the problems and difficulties experienced by the participants in the Digital Transformation process. Thus, it is aimed to include knowledge and skills in the curriculum to classify the difficulties faced by businesses in the digitalization process. In the focus group discussions, one of the participants used the following statement about one of the biggest challenges their businesses face in the digital transformation process.

"Resistance to change" – reluctancy to learn new approaches to work and processes. Because "we've always done it this way, why do we need change? This is the most important issue"

Accordingly, the belief and mentality towards digitalization, which has been underlined in quantitative field studies, has been understood. Because of this query, it is vital that we highlight the benefits for them individually, to adapt and evolve into new processes. This can be an issue due to digital skills or demographic of workforce. The group generally agreed that cultural change was a huge issue in implementing change. Another challenge mentioned was staff training for customization, process mapping and implementation of new technologies/processes, as well as the time resource required in terms of ongoing processes. We also need to make sure we use the digital skills we have to implement changes in businesses. The group felt it was important for an element of human intelligence to oversee, for example, a human's AI decisions. Considering the concerns in the literature in the field of artificial intelligence and thinking/learning robots, the control of artificial intelligence, which is a highly developed and sensitive digital technology element, was important for the participants. The group felt it was important for an element of human intelligence to oversee, for example, a human's AI decisions.

Another difficulty experienced in the digital transformation process was related to the digital transformation roadmap. Accordingly, one participant underlined a great challenge at the beginning of the process, which was to map the storyboard/process regarding the implementation of digital transformation. Accordingly, the importance of allocating more time to "planning" before starting to develop new software, or processes in enterprises has been emphasized. As a matter of fact, one participant stated the importance of this issue with the following sentences: "...Once you have developed the software you will use, it may be much more difficult to solve it when you want to make changes". Another challenge was finding software and systems that were future proofed in terms of the business scaling. One attendee mentioned that, their system was popular at their company, but as the company has grown this has caused issues with integration and now means that many departments work on different systems. It was very important that we look at what is "fit for purpose for the future."

- **Motivations**

The next topic of the meeting with the focus group participants was to understand the "motivation" of businesses in the digital transformation process. The"data" response has come to the fore as the key concept covered in this topic. Accordingly, it has been emphasized that using data correctly was an important power for SMEs, especially in terms of gaining insight in business development processes and reporting processes. As seen in the job posting analysis of the study, it has been stated as an important task-skill definition that the personnel who will work in the field of digital transformation management should have knowledge of data analysis processes (especially big data) for reasons such as managing customer relations, measuring digital maturity and determining KPIs. Accordingly, it has been seen that using data correctly was at the forefront of digital transformation motivations of businesses. Another participant stated that one of the biggest motivations in realizing digital transformation in their businesses was "*facilitate and accelerate applications in business processes*".

Again, an example was given with a focus on improvement in customer relationship management, and it was understood that digital transformation does not only require a complex "transformation" process, and that speed and development can be achieved in businesses with simple applications and processes. Accordingly, a business has stated that instead of being in contact with only one customer by communicating with its customers over the phone, they can contact 3-4 customers at the same time by using the "live chat" feature. They mentioned that with the use of technology in this process, customer experiences and service times in their businesses have improved. Moreover, it has beenstated that this situation leads to a decrease in personnel costs and increases the capacity of the workforce to do more work.

- **Technology Usage**

In the following parts of the focus group discussion, the theme of "understanding the use of new technologies" in organizations was started. In this part of the discussion, answers were received about the use of new technologies, why investing in them, how the company manages investment in these technologies, and the difficulties encountered in this process. It was noted that many participants in the focus group discussions were cautious about the use of the term "new technologie". It was understood that most of the participants did not use digital technologies such as Augmented Reality, Virtual Reality and Artificial Intelligence in their businesses. A participant representing the construction industry stated that the construction industry has a large amount of new technology, but because many businesses are in SME status, it is a barrier to have new Technologies about financial reasons (price levels, profit effect, etc.). These financial reasons (costs) mean that the use of technology in question is not integrated into the normal workflows of businesses. Due to the financial reasons in question and the very thin profit margins resulting from the use of these technologies, it has been stated that companies investing in these technologies rather than SMEs tend to be larger-scale, institutionalized and multinational companies. This leads to a situation where technology becomes more of a showpiece rather than integrating with normal workflows. This situation shows the importance of making new technologies accessible to the masses and especially to SMEs.

"Drone technology" is cited as an example of a new high-end technology, that could be accessible to businesses of all sizes. One participant stated that even small-scale roofing businesses use drones to save time and resources, and shared the experience of one of their business contacts in this regard. When the discussed example is examined, it became an important example of how digital technologies can show a "net return on investment" for businesses. It has been mentioned that VR/AR technologies are currently lagging behind, in terms of net return on investment, and therefore they are not available for mass use. Accordingly, it is important to emphasize the benefits of adopting new technology to the business world, so that businesses can adopt digital technologies earlier.

Figure 3. Drone Technology

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One participant, from the perspective of construction and building management, stated that sensor technology has been widely adopted in their industry. They mentioned that as companies move away from the global pandemic (quarantines) again, they are increasingly looking for ways to re-evaluate and adapt their building use. Accordingly, the usage of the sensors as observation tools to capture data and inform our future decisions for related data, will play an important role in restructuring of buildings. The increasing usage of sensors in the industry depends on the fact that, the equipments have become both more accessible in terms of price and smaller in size. In this context, the cost factor and portability have come to the fore in adoption of digital technologies. A participant with an experience using sensors from the manufacturing industry, highlighted the importance of a sensor network, to obtain reliable data along with the ongoing maintenance of sensors. It was mentioned that monitoring the circuit, process and reliability of these sensors creates more additional work than required, and it was stated that monitoring processes should also be observed. This is particularly important that, the sensors were not only collecting data, but actually providing automated functions – for example, in factories/manufacturing facilities. In the discussions on data use, it was observed that the participants agreed on the importance of collecting, processing and using the data for predictive purposes, and the participants agreed on the rise of the efficiency about data use. One participant stated that they had access to some great data in their business processes, that could help the various industries they work with, but are not currently in a position to make the best use of this data. This person explained that they would have to rewrite the data, and also, this person mentioned that they need customer agreements to allow them to make this data public/use in the future.

We are not making the best use of the data that we collected was a view shared by most of the group. The reasons behind this argument was mainly related to customers; permission, lack of available resources in terms of personnel and time, access to work and digital tools. For example, software integration can sometimes be a barrier to collecting and then using data. One participant discussed a work they did at the Sydney Opera House, where Opera was exhibited, and stated that he used about 42 different asset management software systems. Another problem area was the lack of communication between the various systems and the formats in which the data was produced. This lack of communication was a barrier to making the best use of the data collected. Indeed, another stated statement was quite remarkable. The use of new technologies in food waste, which is one of the most important problem areas of today, was quite remarkable. The use of these technologies—sensors, artificial intelligence, and cloud-based systems—to increase the shelf life of perishable foods not only has a positive impact on the revenues of businesses, but also fulfills ethical responsibilities for sustainability and is an example of digital transformation that has a great impact in terms of legal requirements in this field. As in this example, it has been mentioned that the use of these technologies will become more important as governments work towards achieving 'zero waste' targets.

- **Green Transition**

Finally, the "green transition" process was briefly mentioned in the interview flow. Again, a participant from the construction sector gave interesting examples by talking about the practices in their sector and the current situation. Accordingly, construction technology is being used in terms of changes around materials "from cradle to cradl" and "cradle to gate"" even before businesses begin the process of building a project. Digital tools fuel broader sustainability plans such as BREEAM and building certifications. This resulted in less laborious manual labor and encouraged businesses to plan ahead with new projects for future use rather than demolition after a certain period of time. Accordingly, both the development and use of the buildings were an important topic of this focus group meeting by the participants. Participants externally described "smart meters" as a significant advance in people's

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understanding of the use of both commercial and domestic buildings. Accordingly, the simple addition of a smart meter to buildings prompts the use of smart technology to reduce costs as well as capture data/measure impact.

> **ℹ Reader's Note:** *BREEAM has formed the basis of many green building certification systems as the "BREEAM" (Building Research Establishment Environmental Assessment Method), the world's first assessment system that evaluates, grades and certifies the sustainability of buildings. However, the use of this certification, which is generally limited in the UK, sets the best practice standards for the environmental performance of buildings through design, specification, construction and operation.*

With the green certification and green buildings agenda, it was desired to move on to the discussion "Carbon Tax at the Border", which is at the forefront of the factors that cause the projet's "green digital transformation" perspective. Brief information was given about the carbon tax at the border, but it was observed that none of the participants was aware of the said development. The participants stated that both they and other businesses should keep up with the global effort in the field of climate change and they agreed that they should reduce carbon emissions in their businesses. Regarding this process, they mentioned that air quality measurement studies can be done by using sensor technology to reduce carbon emissions.

Summary Findings

After the focus group meeting, it was seen that the main obstacles to the digital transformation of businesses in the UK include: Cultural difference, dealing with software developers for necessary IT support in the transformation process, staff resistance to change, lack of organizational strategy, communication problem between different departments, lack of experience in the relevant field, inadequacy of managers in using digital technologies, lack of long-term vision (for example, long-term vision) time constraints, limited resources allocated to digital transformation, time required to see the benefits of digital transformation to the business (for example, lack of a quick return on investments), lack of motivation to digital transformation in organizations. Apart from these problems, other prominent obstacles can be listed as follows; problems with high digital transformation costs, problems with investments as an example: the prevailing opinion that digital technologies are too expensive for SMEs and the profit margin is too small ;, problems with customers"; cooperation, acceptance and human resources (eg working in SMEs causing problems of low wages in general, regional gaps, costs to recruit labor in the relevant field, etc.).

The theme of"data-based decision making" has come to the fore regarding the benefits of digital transformation to businesses. Accordingly, it is stated that the use of data strengthens businesses with benefits such as increasing the quality of customer service, supporting customer-oriented decisions, and increasing the vision of the organization by making data-based decisions. In line with the aforementioned benefit, it has been seen that big data technology has come to the forefront in terms of which digital technologies are primarily necessary/important for their businesses. It was stated that this was followed by artificial intelligence, augmented and virtual reality technologies, robotic technologies, internet of things (IoT), 3D printer and drone technology.

Problems have been stated in different titles related to the human resources title, which is an important area in the digital transformation process. Accordingly, briefly, topics such as newly motivated staff, new skills and expertise agenda, lack of vision in the field of digital transformation, need for more experienced workforce, agile thinking and adaptability were highlighted by the participants. At the last stage of the focus group meeting, which topics should be included in the curriculum and modules to be developed in the field of digital transformation management were

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discussed. Participants stated that in addition to the basic modules, there should be topics that will develop the skills required to manage teams in green technologies, artificial intelligence and robotic technologies, and digital transformation management.

> **ℹ Table of UK Findings**
>
> **Digital Skills:** Participants agreed that key new technology skills are 3D printing, Big Data, Artificial Intelligence (AI) and Internet of Things (IoT). The group saw data as a key skill to use and process data in the best possible way to better apply new technologies and bring great success.
>
> **Organizational Skills**: Among the organizational skills classified under management skills, these topics, particularly Strategy Planning and Creation (Innovation Strategy), Digital Maturity Measurement Skills and Change Management, were chosen as the most important skills. It was mentioned that the titles in the skill cards will need to be filtered to the built-in modules. Thus, it will be possible to deal with multidimensional management skills.
>
> **Green Skills:** The green skills, which were listed last, were presented to the participants within the scope of the research. It was observed that the participants expressed opinions about seeing the titles of Green Literacy, Resource Management, Green Technology and Circular Economy in the modules.

II.   Türkiye Findings

The field research, which was planned to be conducted as a focus group interview, was conducte using the "in-depth interview" method due to the Covid-19 pandemic conditions in Turkey. In-depth interviews were completed using " different access methods: computer assisted (cawi) and telephone assisted (cati). Accordingly, in-depth interviews conducted by Istanbul Mineral Metal Exporter's; Association (Immib) and Istanbul University were carried out with the participation of different sectors such as chemistry, metal and machinery manufacturing. A total of 10 enterprises, representing different enterprises, 40+ years from the start-up stage, took part in the interviews. Participants were completed with the cooperation of participants from various departments such as export manager, business owner; partner, information technology manager, human resources manager. The participants were briefly informed about the goals and objectives of the project, and the importance of this interview was mentioned in order to achieve these objectives. Semi-structured interviews were discussed under five headings as in other partner countries. These are: Understanding digital transformation, use of new technology, human resource issues, green skills needs and curriculum design section.

"...A digital leader can clearly articulate why transformation will benefit the business, which encourages the wider workforce to embrace change".

"A change in processes and the introduction of new technologies for a business will only be successful if the workforce feels sufficiently supported with the skills to embrace the change."

Another participant touched on the concept of digital transformation from a different perspective than other businesses. Accordingly, the participant brought an interpretation outside the classical meaning of digital transformation due to the current situation of their own businesses. Mentioning that classical digital transformation is not possible due to the current structure of their businesses, he used the following expressions *";We cannot use the robotic technologies brought by Industry 4.0. We use more human labor than automation-oriented production. Although we are trying to switch to automation, we do not think that the use of automation in our production system exceeds 10% in the current situation.*" In fact, this situation has led to the idea that "digital transformation" is no longer a phenomenon in the classical sense, and that it needs to gain meaning by adapting it to the existing structure of businesses. Digital transformation is not just a technology adaptation and a process transformation needs to be perceived. Accordingly, digital transformation is not just a technology change, but refers to skill use, process management and mentality change.

In the next stage of the interviews, information about the concept of digital maturity was given to the enterprises and it was tried to determine the stage of the digital transformation processes of the enterprises. The digitalization plans of the enterprises were questioned and how the enterprises that realized and/or wanted to realize digital transformation planned this transformation was examined. Accordingly, it has been understood that the majority of enterprises are at the level of"beginner" or "intermediate level" from the announced digital maturity levels. While it is understood that businesses have achieved partial digital transformation, especially in departments such as sales and marketing and business development, it has been observed that they aim for a digital transformation that covers all of their businesses in the long run. Accordingly, it has been observed that businesses aim for "partial digital transformation" in the short and medium term in line with their priority departments, and they plan to realize digital transformation in all their departments with a "holistic" transformation target in the long term.

> *"...We want to do digital transformation for processes such as taking orders and invoicing. In the United States, there are software that perform operations such as export invoices (issued to the customer) and normal invoices (declared to the government) in a single module. In addition, software that facilitates order tracking and gives notifications to the customer such as "goods loaded, your order is on its way" t; is used. We would like to reach this level through the digital transformations we carry out"*

A business aiming to achieve partial digital transformation was asked in which area(s) it plans to realize digital transformation. Accordingly, in response, it was seen that instead of using complex technology, the first thing that comes to mind when digital transformation is mentioned is a plan about digital business processes, which is a very simple but effective and efficient transformation.

The aforementioned participant stated that their motivation in realizing this transformation was to facilitate business follow-up. Another company could not define the level of digital maturity of their business, but mentioned that they produced prototypes with 3D printers and provided a good example of in which areas digital technologies can be used. In addition, he mentioned that they use a tracking system, which is an operational improvement application, and used the phrase

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> ℹ️ *"...We follow the production times by remotely following the production machines and we use auxiliary systems that follow up the malfunctions"*

The fact that the company, which uses digital technologies in various fields such as customer relations, stock management, operations management, did not give an answer to what maturity level they define themselves, has shown that the business has transformed without a level of progress. This can be given as an example of businesses that perform digital transformation in different areas without planning. Researches show that businesses whose progress and transformation are not leveled and well planned may experience various difficulties in the future digital transformation process (resource usage, integration problems, skill problem, etc.). This situation may cause potential problems and workloads, cost increases (or losses) of digital transformation in the future.

Another participant mentioned that they have realized partial digital transformation in different departments in accordance with the needs and summarized their current situation with the following statements.

> ℹ️ *"..Since they are in a human labor-intensive industry, it is not possible to completely transform. Production has been automated by 10%. In addition, software for design, SAP, some accounting programs, agile systems are used in sales tracking. We can say that within the scope of the management, digitalization has been realized at the rate of 20%"*

In the next stage of the interviews, information about the concept of digital maturity was given to the enterprises and it was tried to determine the stage of the digital transformation processes of the enterprises. The digitization plans of businesses were questioned. In addition, it has been examined how businesses that realize and / or want to realize digital transformation plan this transformation. Accordingly, it has been understood that the majority of enterprises are at the level of "beginner" or "intermediate level" from the announced digital maturity levels. It has been observed that businesses provide partial digital transformation, especially in departments such as sales and marketing and business development, and they aim for a digital transformation that covers all of their businesses in the long run. Accordingly, it has been observed that businesses aim for partial digital transformation in the short and medium term in line with their priority departments, and they plan digital transformation in all their departments with a "holistic" transformation target in the long term.

- *Motivations*

Keywords describing the digital transformation motivations of businesses emerged as follows: Primarily customer trends, ensuring traceability, new customer acquisition, import-export development, competitive advantage, innovation, productivity increase, reducing operational costs; especially labor, reducing margin of error, increasing quality, ensuring correct use of data.

- *Difficulties*

Financial inadequacies in meeting digital technologies, integration problems, resistance to change, lack of needs analysis, lack of qualified human resources, inadequacy of public support have been observed to be the problems faced by businesses in the digital transformation process. Among the mentioned problems, it has been seen that the most recurring and common difficulties are the resistant attitudes of businesses and especially managers against change, inadequacy of qualified human resources and insufficient financial capacity to meet digital technologies.

- ***Technology Use***

After determining the attitudes, current situations, motivations and problems of the participants towards digitalization, the topic of"use of new technologies"was discussed. In this part of the discussion, answers were received about the use of new technologies, why they were invested, how the company managed to invest in these technologies, and the difficulties encountered in this process. "*Do you actively use any of the new generation digital technologies in your business? Which technologies do you use*?" Questionnaires were asked to the participants and their status of owning the tools in the list of digital technologies was asked.. When the use of the listed new technologies by the enterprises is examined, it is seen that they use many technologies in different departments. Regarding the mentioned technology uses, it has been observed that technologies such as cloud technology, horizontal vertical software integrations and big data technology are dominant. When the most common usage areas of these technologies are examined by the participants, it can be said that the title of data management comes to the fore. When the investment decisions of the enterprises for the mentioned technologies are examined, it is seen that the majority of the enterprises use their own internal human resources or manage this process by taking environmental advice. In this process, it has been understood that businesses that turn to outsourcing (consulting services, etc.) are limited to financial reasons.

- ***HR and Skills Needs (Challanges)***

In the next phase of the interviews, continued with the themes of "human resources problems" and "understanding the skill gap". Accordingly, in order to understand the human resources that businesses use in the digital transformation process;

- Use of human resources in the digital transformation process (internal human resources-outsourcing distinction)
- Problems arising from the use of human resources (skilled labor shortage)
- Human resource profiles that will be needed in the digital transformation process,
- Defining the competencies expected from the personnel to be recruited in the digital transformation management process

Human resources situation assessment and skill gap were determined. The majority of the participants showed that businesses are involved in the digital transformation process with the use of existing human resources (internal human resources). Companies have subjected their personnel to intensive training through consultancy service. Thus, they tried to fill the skill gaps in their businesses. Many businesses have turned to internal human resources. Despite this, it has been observed that some of the enterprises go to outsourcing in their specific fields of expertise. Accordingly, it has been observed that some enterprises do not have problems in terms of personnel supply and skill needs for widespread technologies. However, some enterprises have stated that they have problems in the supply of personnel on issues such as the use of new and special softwares.

> '*Autocad, 3D Printer is easy for skills needs but difficult for new and specific software. We outsource consultancy for specific cases.*'

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> *'We have a digital stock management application, but it is prone to mistakes. A Data and Reporting Specialist has recently been recruited in our company. Considering the important issues such as KVKK[1], I think that a Privacy Consultant may also need to be employed.'*

This demonstrated the problem of skill adaptation to changing technologies and processes. Given the ever-changing processes and emerging technologies, it has become clear that skills adaptation processes need to be more 'agile'. When the skills to be demanded from the personnel who will take charge in digital transformation management were questioned, results were also obtained in parallel with the field studies. The participants stated that there should be "solution-oriented" personnel who can understand the digitalization needs of their departments and can produce solutions. In the implementation of the solutions produced, it was emphasized that the personnel should have "digital leadership" qualifications. Apart from this, it has been seen that skills such as project management knowledge, business model design, analytical thinking, literacy to follow new technologies are the competencies required from the personnel responsible for digital transformation. In the field researches conducted in Türkiye, UK and Germany, the Personal Data Protection Law (KVKK) and Information Security were mentioned. Accordingly, in the majority of the interviews, it was emphasized that the personnel who will take charge of digital transformation management should have knowledge on these topics. During the pandemic period, businesses have focused more on areas such as remote work and e-commerce, and the need for personnel who are competent in digital marketplace applications and who know digital marketing and customer analytics have been emphasized by businesses. In this context, considering that the digital transformation in businesses has accelerated in these departments recently, the increasing demand for personnel with knowledge and skills in these topics has been understood. Accordingly, it is considered important that the personnel who will work on digital transformation management have knowledge and skills in these topics.

- ***Green Skills (Challanges)***

In the next phase of the interviews, the theme of "green skills" came to the fore. Participants were informed about the carbon tax regulation at the border, and awareness was raised on the participants about this new regulation. In the interviews, it was seen that the businesses have half awareness about the carbon tax at the border however some of businesses have started to work with actively for this issue. A company representative from the chemical industry stated that; use to recycle and environmentally friendly packaging-products in the practices of their businesses for regarding the carbon tax regulation at the border.

> *"...The motors of the devices used in production use high electricity, we can evaluate this issue in terms of adopting environmentally friendly technologies. Apart from this, the products we produce are natural and do not have any negative effects on the environment. Also, we use recyclable material in packaging boxes. The creams are produced without using water and offered for sale in a chasis package."*

Another participant was present in the interview, representing the "Electricity" and "Plastic-Chemistry" sectors, which are among the important sectors that will be affected by the carbon tax at the border. The participant stated that they have started carbon footprint measurement studies. They also stated that they actively use renewable energy sources. He talked about the steps they took about the "Solar Panel" technology.

> *".....We have created an in-house Commission on this subject. We also have a Sustainability Commission within our Quality Department. We will soon have a carbon footprint measurement. By installing solar panels on the roof, we started to obtain 50% of our energy from the panel."*

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[1] Türkiye Personal Data Protection Law (no. 6698)

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"…The most important issue was the high energy consumption in our company. Therefore, we replaced 60% of our machines with new technology machines that "will consume minimum energy". This year, we renewed the roof panel and we get 40% of our energy from the sun. Zero fossil fuel We try not to use it. Apart from this, we have attempts to use environmentally friendly alternative raw materials in plastic production."

Summary Findings

Aftter the interviews, it was seen that there are priority problems/barriers faced by businesses in the digital transformation process. Accordingly, the barriers are: Integration problems, especially financial problems, resistance to change, lack of needs analysis, lack of qualified human resources, inadequacy of public support. Among the mentioned problems; Resistant attitudes of businesses and especially managers against change, and the inadequacy of qualified human resources in specific technologies have been other barriers. In addition, they stated that they have priority human resource needs on issues such as KVKK and information security.

It has been observed that steps have been taken in customer relations, especially in applications such as e-commerce and market place, in businesses where digitalization accelerated during the pandemic period. Accordingly, the need for knowledgeable personnel in related fields has increased more for marketing and e-commerce. It has been observed that companies, which are mostly seen as beginning or mid-level digitalization, aim for department-based digital transformation in the short term, but have a holistic transformation vision in the long term. On the other hand, it has been observed that half of the participants are aware of the carbon tax regulation at the border. It has been observed that some enterprises have exemplary practices in different areas such as the use of alternative energy, carbon footprint measurement, the use of recycled products-packaging, the use of alternative raw materials, and green technology adoption in the field of environmentally friendly business processes and practices. In the selection of skill cards, different skills such as project management, strategic planning, digital literacy, autonomous robots, 3d printer, change management, digital maturity came to the fore. Accordingly, it has been understood that the personnel who will be responsible for digital transformation management should have a wide range of knowledge and skills.

III.   Germany Findings

All interviewees' understanding of digital transformation follows a business pattern: 'inside' vs 'outside' a company. As regards digitalization, this distinction is made between 1. internal corporate processes and functions esp manufacturing, and 2. external market operations and interaction with clients and suppliers. The former perspective suggests that digitalization promises higher efficiency and smoother operation. The latter one is said to create new opportunities, activities, services and business models. It is generally emphasized that both perspectives correlate in as far as external 'digital' activities require adequate internal conditions and in return, a digitalized organization can embrace new external opportunities. Digitalization is thus not seen as a mere efficiency drive but also as a wave of opportunities not to be missed. Examples are emerging digital services in agriculture and the building industry and new business models in household management services (was 'appliances').

General agreement and also enthusiasm regarding the benefits and opportunities in those two fields is universally expressed but with a more shaded reservation: digitalization can easily be handled as a fashion and image-building trend but should actually be approached with diligence and preparation. This seems to coincide with statements in which all interviewees see their companies neither as trendsetters nor as mere followers. The dominant picture is that of an analytical and critical approach in which real internal conditions are weighed critically against abstract visions of opportunities. The range of topics that digitalization, in the eyes of those companies, involves spans a broad spectrum of corporate activities:

> ℹ️   *The similarities in interpreting the concept of digitalization are striking but not surprising, all the more as the three businesses interviewed are either large and mature family businesses or tech-savvy SMEs.*
>
> ✓   *Administration and data handling*
> ✓   *General introduction of digital technologies and data-driven processes*
> ✓   *Additional and high-quality business intelligence to be obtained through data*
> ✓   *Analytics and emergence of AI solutions*
> ✓   *Re-organization of supply chain and distribution*
> ✓   *Rachine-to-machine communication mainly in robotics for manufacturing*
> ✓   *New products and services, new approaches to R&D*
> ✓   *IT literacy and new learning environments*
> ✓   *Mindset and attitudes towards change*
> ✓   *Organizational hierarchies, team building and cross-disciplinary communication.*

In universal agreement, all interviewees claim to have designed their own approach to digitalization. Remarks made by interviewees suggest that what determinates these respective approaches seems to be:

✓   The corporate culture and the company's readiness for digital change,

✓   The support from senior management,

✓   The specific and seizable benefit(s) seen in digitizing a certain activity,

✓   The search for a 'tempered' way of dealing with change, let alone disruption,

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✓ The demand for digital products and services in the market

Where the companies interviewed do differ is their approach to implementation and the impact of market specifics and diverse corporate cultures. The following variations of this diversity topic have been detected:

✓ Idiosyncratic approaches to Digitalization with strong insistence on the respective
✓ Corporate culture and specific needs
✓ Adversity to disruption of specific corporate functions and endeavors to protect core processes
✓ Diversity in 'evolutionary' approaches to implementation of digital processes
✓ Diverging attitudes to benefits of hiring external consultiung services
✓ Specific models of rolling out digital innovation, ranging from satellite to internal task
✓ Force to cross-departmental labs or talent pools to 'ricochet' approaches in which one
✓ Function after another is digitalized
  Digitalization seen as a long-term process to be approached selectively and with a view of short-term vs lon-term benefits
✓ Company-specific priorities defined for functions to be dgitalized, e.g. parts of manufacturing vs entire supply chain, distribution vs customer bonding, machine-to- machine interaction vs administratuve processes
✓ Involvement of universities a suppliers of HR vs providers of R&D

The following variations of implementation strategies have been found:

✓ Implementation by function and corporate activity, not globally from head to toe.
✓ Setting clear priorities based on (a priori intelligible) clear benefits
✓ ncreasing manufacturing efficiency by switching production chains to wireless machine-to-machine, function-to-function and department-to-department interaction.
✓ Installing a satellite company developing, apart from efficiency-enhaced solutions, new products, markets and organisations
✓ Installing a Digital Tranformation Office that oversees and supports digital change across departments
✓ Building digitalization clusters and ad-hoc networks inside a company that are organized both horizontally and vertically.
✓ Involving universities at senior management level. All innovation processes installed not only top-down but also bottom-up. Allowing for permeability and diffusion of digital innovation processes.

Understanding the use of new Technologies: A widespread understanding of Digitalization is that it is about technologies. This is a limited but somehow understandable view. All respondents consistently refer to the wider context that will affect organization, corporate culture etc. They do insist, however, on the urgent need for specific technological skills that companies need to upgrade and acquire.

- ***Specific digital technologies and their absorption***

A look at the specific technologies selected for adoption and implementation will reveal parallels with companies' overall outlook on Digitalization as all technologies are considered in their immediate to mid-term payback and specific benefit and less in their contribution to an overall desirable state of the organization. All interviewees agree there is no real Big Bang of technological development, but something like a long-term stairway to (digital) 'heaven'.

The drivers of Digitalization are seen in the benefits and added value for businesses and consumers, and of course not in technology for technology's sake. These benefits are thought to be:

- ✓ More efficient manufacturing,
- ✓ Higher performance in distribution,
- ✓ Better and partly realtime control of all corporate functions
- ✓ More effective client service
- ✓ Market opportunities i.e. new products and services, larger reach and larger audience (quoted with slight hesitation but conviction)

The following benefits seen in specific technologies vary in appreciation depending on the respective company's ambition and level of achievement in Digitalization. All intervieewees see connectivity as a prerequisite of digitalization and a relatively low-threshold challenge. Although digital connectivity is perceived as a basic stage of the Digitalization journey, they do nevertheless emphasize their company's achievements, which may be a slight indication that mere connectivity is a relatively recently accomplished status quo. More advanced applications using connectivity in machine-to-machine communication and similar are less emphasized and do not seem to have been implemented by all companies. Usage made is mostly in realtime stock control, warehousing, logistics, distribution and, at higher level but in rarer cases, machine-to-machine communication and Robotics. Specific difficulties with connectivity are experienced in agrculture and construction i.e. physically mobile oerpations, and less in stationary value creation such as manufacturing or administration.

Sensoring applications are by far not new to business and manufacturing but have taken on new meaning by connections made to Data Analytics and Robotocs. Mere (e.g. optical or chip-induced, e.g. RFID) recognition is standard on the data input and and automated execution side e.g. in manufacturing (less in administration) or logistics but less often found as a trigger of digital decision-making let alone smart contracts. The benefit of sensoring itself is fully acknowledged but its exploitation in the wider value chains more of a novelty. Pioneering applications are, e.g. in agriculture, the collection, processing, sharing of weather (forecast) data cum automated fleet deployment or automated machine maintenance planning in manufacturing. The potential of realtime tracking and tracing for control and, as a more advanced step, for business development is, on average, acknowledged but not fully used. Certain use cases have demonstrated low reliability for technical reasons but also due to problems or little experience with Data Analytics and data cleaning.

- ***Understanding Human Resource Issues in Digitalization***

All participants agree that Digitalization requires new skills profiles and skills mixes. These concern:

- ✓ Specific (digital) technologies and data awareness
- ✓ Management and organizational skills (depending on hierarchy levels), digital leadership
- ✓ Soft skills (communication, teamwork, initiative, cross-culture,)
- ✓ Personal dispositions, qualities and attitudes (change resilience, creativity, uncertainty resistance,

Another common theme is the age pyramid within the workforce and the diversity found in learning mode, speed and motivation. New recruits will usually bring learning habits different from staff in jobs. Older staff take longer to adapt their tech skills by training, self-study or in other ways. Younger staff tend to move more quickly. This diversity leads companies to choose specific training and learning approaches for specific target groups. Companies tend to focus specifically on specific groups, addressing target groups in line with specific conditions and evident

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benefits. Talent and experience retention is a common worry so approaches depend on audiences and are carefully scaled and calibrated.

The problems encountered in competence development are more in convincing and winning over staff than in the content of the learning objects. The respective task is thus less of a cognitive but more of an affective and psychological 30loud30 in which empathy and experience brought in by management are key. This needs to be complemented by incentives, time, and freedom granted so that opportunities are seizable. Opportunities are to be understood, explored, tested and investigated with curiosity. In this effort, gamification of learning items and processes can help immensely. The freedom that ideally characterizes learning processes is to be matched by a culture of error and a rejection of an often dominant culture of perfection. Step-by-step learning and a gradual adoption of skills following a motto like #ever better is found to be key. Considering the pace of technological change, all respondents opted for flexible learning and training agendas that are to reflect actual and specific corporate and individual skills needs rather than broad profiles acquired in storage learning settings. It was unanimously clear that general data affinity, and more specifically skills like creating, collecting, processing, securing, analyzing, and sharing data should be at the heart of learning agendas. At a more specific level, 3D printing in development and technical design environments and also in manufacturing was also considered an asset. Competence in managing 30loud storage and service solutions is to complement data skills. At a more basic level, which applies in particular to the building sector, smart collaboration and wireless connectivity are seen as the more immediate challenges. Most technical skills requirements are, however, addressed in a selective and targeted manner through online study services. Despite the fuzziness of technical qualifications future specialists will require and a perceived shortage of technology awareness among senior commercial management, HR departments seem less concerned with matching technical skills needs than with hiring staff with adequate soft and personal skills profiles.

The changes imminent in organizations will concern hierarchies, management and leadership styles, value chains and corporate processes, customer relationships, team organisation, stakeholder relationships and project management. It is interesting to note that those businesses that see themselves as advanced in this respect also seem to have embraced digitalization most actively. Despite obvious successes there are also bottlenecks and slowdown factors though. These concern technical skills shortages as mentioned above, the sometimes slow change in management culture ('from directing to coaching') and lengthy mainstreaming processes in which innovations are implemented. A variety of models are used to promote digital change. Popular approaches seem to be; Creating digital 'satellite' labs as separate units – sometimes as separate legal entities -developing innovative products, services and processes; Building digital talent pools that make digital skills available across divisions and departments of companies; Combining these talent pools with traineeships offered to young graduates that are immersed with teams and assigned specific digitalization tasks; Using student internships for analyzing digitalization options; Identifying pioneer units for digitizing processes with the chance of upscaling change processes later; Calling on universities for supporting skill bulding programmes; Restricting engagement of external consultants to a necessary minimum.

- ***Green Skills***

All efforts seem to point at more flexibility, cross-disciplinary processes, higher uncertainty tolerance, disappearance or breaking up of formal hierarchies and more co-operative and collaborative structures in companies. It is self-understood that these trends play out to degrees varying considerably from one company or department to another.

The skills required in this are thought to be:

- ✓ Life cycle awareness regarding corporate output and products
- ✓ Carbon footprint measuring and reporting
- ✓ Awareness of relevant standards, norms and legislation
- ✓ Design thinking and stakeholder involvement
- ✓ Awareness of sustainability as a brand quality
- ✓ Circular and resource efficiency thinking
- ✓ Supply chain management
- ✓ Mobility management
- ✓ Enhanced science (chemistry, physics, biology) knowledge

It is acknowledged that not all skills are yet up to challenges but motivation to comply with standards and mitigate adverse effects is found to be high, all the more as support from workforces is seizable. Data management is expected to play a crucial role in monitoring corporate sustainability performance, which is why companies are optimistic they can quickly achieve breakthroughs. In this context, they point to the long-term continuity they have already built in resource efficiency and their active commitment to a cleaner environment.

> *Based on Germany interwievs, briefly, any curriculum designed for addressing digitalization needs to address the following topics as a minimum requirement, all respondents state:*
>
> - ✓ *Data management and data analytics*
> - ✓ *Change, innovation and organizational reform*
> - ✓ *Digital collaboration*
> - ✓ *Quality of products and processes.*

PHASE III: JOB POSTING ANALYSIS

The aim of this section is to determine the current competency demands of individuals who will work in the field of digital transformation management in Türkiye, Germany and UK, in the labor market, by analyzing job postings. In line with the determined purpose, current job postings were determined by using keywords such as digital transformation specialist, digital transformation officer, digitalization manager. The job postings in question were analyzed in a way to reveal the education, equipment and personality traits that employers are looking for. It is aimed to reveal the required qualifications by examining the existing advertisements with text mining.

The phrase "text mining" is generally used to denote any system that analyzes large quantities of natural language text and detects lexical or linguistic usage patterns in an attempt to extract probably useful (although only probably correct) information (Sebastiani, 2002).Text mining is a method used to analyze and discover necessary information in large amounts of data, such as summarizing information and providing an overview of the content, identifying and clustering hidden groups among the data, and categorizing them (Atkinson, 2000:58). With text mining, it is possible to identify, decompose and cluster patterns in large volumes of qualitative data such as websites, archives, and web-based resources. In this sense, in today's information economy, where information is predominantly web-based and presented, text mining facilitates the access and understanding of the data in question. Data capture, which is used by different disciplines, especially market research, is a method frequently used in determining skills and professional profiles in the field of human resources recently. Text mining basically takes place in 5 steps.

> *a) Collecting information from unstructured data.*
> *b) Convert this information received into structured data*
> *c) Identify the pattern from structured data*
> *d) Analyze the pattern*
> *e) Extract the valuable information and store in the database.*

At this stage of the research, a resource that can be used by the curriculum to be prepared in the field of digital transformation management or future studies has been revealed by using text mining. With these analyzes, it is aimed to understand the demands of the labor market in depth. Thus, steps were taken to resolve the job-skills mismatch, which is an important problem in the European Union and partner countries. Existing vacancies in the labor market were examined and what should be prioritized while making career planning of the relevant students was examined. In the dataset of the study, Kariyer.net; isbul.com; Advertisements were pulled from various career sites in project partner countries such as indeed.com, jobware.de and yourfirm.de. After collecting the qualitative data set, preprocessing such as capitalization, punctuation, sequencing, etc., the data set was made ready for analysis. Relevant data has been filtered for Germany, Türkiye and the UK, both separately and cumulatively. Thus, the comparison of the existing markets of the countries in the demand for work-skills (benchmarking) was also provided. The variables to be analyzed in the data set were gathered under "three" main headings by the project team in accordance with the European Qualifications Framework.

Accordingly, these postings are thematically classified as the qualifications requested from the personnel who will work in the field of digital transformation management, including the experience period, educational background, job description and qualifications. These competencies are coded in two sub-groups: professional competencies arising from the job and defining professional competencies, and personal competencies covering other common

competencies required in the process of working together outside the job description of individuals. Accordingly, in this section, the following questions were tried to be answered during the analysis of job postings:

> ℹ️
>
> ✓ *What are the professional competencies that employers demand in personnel responsible for digital transformation?*
> ✓ *What are the primary personality traits specified in the recruitment process?*
> ✓ *What is the relationship between educational background and experience in the field of digital transformation management and professional competencies?*
>
> ℹ️ **Variable List**
> Experience backround
> Job description
> Competencies
>   ✓ Personal competencies
>   ✓ Professional competencies

R Package Program and MaxQDA were used together in performing the related analyzes. Thus, both the requirements of the labor force in question were determined and the required qualifications were examined in detail. Descriptive findings obtained from focus group interviews and interviews and field surveys were supported by the contents of job postings. This situation allowed the skill needs to be defined to be deepened. The reliability and validity of the data has been strengthened. It is aimed that the training outputs to be prepared in the project will eliminate the possible deficiencies against the job-skill mismatch, which is an important problem in the labor market.

With the classification and processing of job postings, a total of 424 codings were made in 3 thematic areas. Accordingly, first of all, personal competencies were examined independently of professional competencies in job postings. In this process, "9" topics were themed, mainly teamwork and management skills, analytical thinking and problem-solving skills, and communication skills.

Personal Competencies
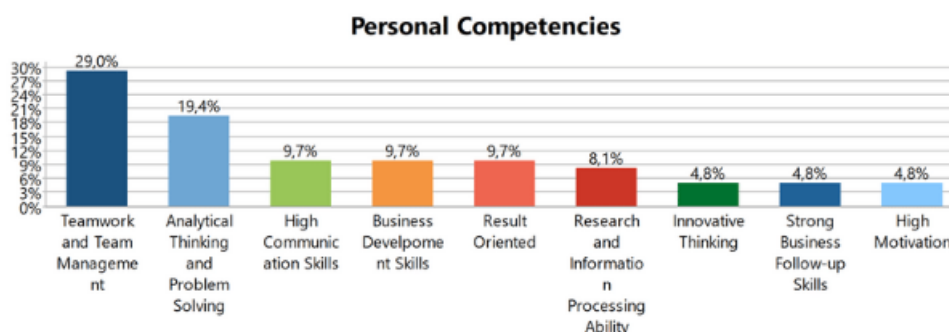
When the relevant competencies were brought into quantitative form by taking the frequency value, Teamwork and Management Skills came first with 29.0%. In the related advertisements, it has been understood that the digital transformation process is a product of teamwork, since it is carried out by different departments or by multidisciplinary teams. Accordingly, it was emphasized that the personnel who will take part in digital transformation management should be both prone and compatible with teamwork and have the necessary

qualifications in the field of team management. The second ranked personal competence was analytical thinking and problem skills, which stand out due to the analytical nature of digital transformation. In addition, it has been seen in the relevant advertisements that the analytical thinking, reasoning and problem-solving abilities, which were considered cognitive skills of the personnel, who will work in the field of digital transformation management, were at the forefront.

	UK	Germany	Turkey
Personal Competencies			
Innovative Thinking	▪	▪	
Result Oriented	▪	■	■
High Motivation	▪		▪
Analytical Thinking and Problem Solving	■	■	■
Strong Business Follow-up Skills		▪	▪
Research and Information Processing Ability	■	▪	▪
High Communication Skills	▪	■	■
Business Develpoment Skills	▪	▪	■
Teamwork and Team Management	■	▪	▪
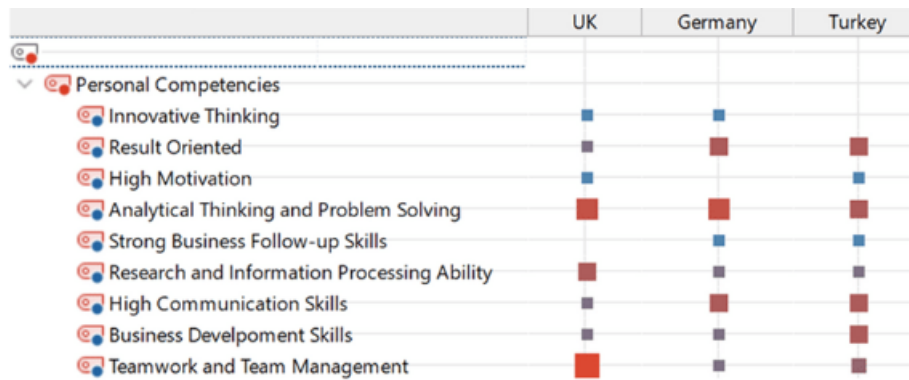
When the titles such as data-based decision- making processes management, research, data-based work, and customer experience, which were among the job descriptions shared in Table 3, were examined. It was thought that the mentioned skill was an absolute feature. It was observed that the prominent findings were followed by personal characteristics such as communication skills, business development ability, and result-orientedness.

Professional Competencies

Competency	%
Digital Leadership	18,7%
Project Cycle Management	16,3%
Innovation Managment Methods	14,6%
Digital Tools and Digital Business Process Knowledge	13,0%
Change Management	8,9%
Software Integration Systems (SAP, ERP etc.)	4,1%
Digitalization Legislation	4,1%
ICT Infrastructure Knowledge	3,3%
Fintech Knowledge	3,3%
Product Lifecycle	3,3%
Office Programs Knowledge (Excel, PPT vb)	3,3%
Production Management Systems	2,4%
Business Intelligence	2,4%
Digital Drawing Tools/Programs	1,6%
Digital Transformation Certification	0,8%

The second theme of the job postings analysis was the professional qualifications that the professionals who will perform the digital transformation management profession should have. In this process, frequently repeated codes in job postings were converted into quantitative form an listed in line with frequency values. With the coding made, it was seen that professional competencies were clustered under 16 titles. At the end of the examination of the frequency values in question, it was seen that the prominent competence in the digital transformation management process is Digital Leadership, which represents a partially abstract competence. As a matter of fact, it has been seen that this competence, which stands out with 18.7% among other codes, can be a common competence without the main field of activity or service field in which the enterprise operates. Project management knowledge (16.3%) followed digital leadership very closely, while knowledge of innovation methodologies, in which skills such as scrum, agile, and design-oriented thinking approach were clustered together and coded, took the third place. It has been observed that this ranking is followed by competencies such as having knowledge about digital tools and

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processes such as 3d printer, internet of things, drone technologies and artificial intelligence, which are defined as industry 4.0 tools. It has been observed that this ranking is followed by competencies such as change management knowledge, knowledge of horizontal and vertical software integrations such as SAP and ERP systems.

When these competencies are visualized with the word cloud, it has been observed that the experiences requested from the personnel who will take charge in the field of digital transformation management of the enterprises are shaped in the axis of the professional competencies listed above. Relevant competencies were examined with the code density graph, and the density of the coded competencies on a country basis was examined. Accordingly, market comparison was provided in line with the frequency value of documented competencies.

When comparing the themed professional competencies for the project partner countries UK, Germany and Türkiye, it was seen that there were significant differences in the skill demands of these countries. As a matter of fact, the primary qualification demand concentrated in the UK market for professionals, who will work in the field of digital transformation management has been about having knowledge of digital tools and processes. In Germany, on the other hand, it was seen that the concept of digital leadership came to the fore. In Turkey, it has been seen that project management knowledge, which directly defines a digital skill but was a complementary competency, has come to the fore. Project management knowledge was again an important competence demand for the UK and remained relatively in the background for the German market. Again, for the UK, having knowledge and skills in the field of change management and the ability to manage change have been at the forefront.

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Kod Sistemi	Germany	Turkey	UK
⌄ YETERLİKLER			
⌄ Professional Competencies			
⌄ Innovation Managment Methods			
Design Thinking	■		■
Agile and Scrum Methodologies	■		■
ICT Infrastructure Knowledge	■	■	
Digital Transformation Certification		■	
Change Management	·	■	■
Project Cycle Management	■	■	■
Production Management Systems	■	■	
Product Lifecycle	■	■	
Software Integration Systems (SAP, ERP etc.)	■	■	
Digital Leadership	■	·	■
Digital Tools and Digital Business Process Knowledge	·	■	■
Fintech Knowledge	■		
Business Intelligence	■		
⌄ Digitalization Legislation		■	
ISO 27001		■	
Digital Drawing Tools/Programs	■	■	
Office Programs Knowledge (Excel, PPT vb)	■	■	■

In Germany, agile and scrum methodologies have come to the fore. In line with the said comparison, it has been determined that the skills demanded in the field of digital transformation management in Germany, Turkey and the UK markets were quite different from each other, but they were in line with cross-cutting topics. In addition, it was concluded that priority skills should be developed. The other question of our research was about "what jobs the professionals who will work in the field of digital transformation management will perform by using the mentioned competencies". In this process, which job descriptions are expressed in the field of digital transformation management in job postings were examined. In addition, common recurring titles in the reviewed job descriptions were themed. Job descriptions were grouped in 11 thematic areas. In the first place, it was seen that the primary activity that enterprises will carry out in the field of digital transformation management was to define the digitalization needs of institutions and to develop their digital transformation strategies (15.8%). In the second place, it was seen that a job description related to "big data", which was one of the important areas of industry 4.0, emerged. It was define,d as the personnel who will work actively in data-based decision-making processes, especially in marketing and customer relations and digital maturity of enterprises (14.2%).

Job Descriptions

Digitalization Needs Analysis and Transformation Strategy	15,8%
Data-driven Business Process (Digital Maturity, KPI etc)	14,2%
Cooperate Relations Management (with digitalization centers etc)	12,1%
Project Managment (Technology Based)	10,5%
Budget and Feasibility Reporting	9,5%
Customer Relations Management	8,4%
Collecting and Coordinating Innovation Ideas	7,9%
Research, Digital Trend Tracking and Business Model Design	7,4%
Planning and Coordinating Digital Transformation Operations	7,4%
Organizing Trainings and Seminars in the Field of Digitalizatio	4,7%
User Acceptance Testing (UAT) and Customer Experience Managment	2,1%

Managing relations with corporate actors such as digital transformation centers, technology centers and relevant departments of public institutions (12.1%) came to the fore in the third place. The first three competencies that come to the fore in the related study reveal that, the personnel who will work in the field of digital transformation management, will actually have a complex and complementary work plan.

Kod Sistemi	Germany	Turkey	UK
⌄ Job Descriptions			
User Acceptance Testing (UAT) and Customer Experience Managment	■	▪	
Digitalization Needs Analysis and Transformation Strategy	■	■	■
Research, Digital Trend Tracking and Business Model Design	■	■	▪
Organizing Trainings and Seminars in the Field of Digitalizatio	■	■	▪
Data-driven Business Process (Digital Maturity, KPI etc)	■	▪	▪
Project Managment (Technology Based)	■	▪	■
Budget and Feasibility Reporting	■	■	■
Customer Relations Management	■	■	▪
Collecting and Coordinating Innovation Ideas	■	▪	▪
Cooperate Relations Management (with digitalization centers etc	■	■	■
Planning and Coordinating Digital Transformation Operations	▪	■	■

When the mentioned job descriptions are examined in the project partner country market, it was seen that generally similar job descriptions were made in all three countries. On the other hand, it has been seen that the prominent job definition in the UK   defined the digitalization needs and develop a strategy. In Germany, it has been seen that the job definition, which expressed digital maturity measurement and data-based decision-making processes, has come to the fore. It has been observed that there was no dominant definition in the field of digital transformation management in Türkiye market, and in general, all thematic areas were similarly distributed. In the last stage of the job posting analysis, the intersections of themed competencies and job descriptions were examined. Accordingly, competencies and job descriptions that intersect at least twice were visualized in line with code densities. In line with the intersection table below, the most prominent competence-job description groups were as follows. In this process, the interaction of the five most prominent competencies in the project with job descriptions was examined. It has been seen that the concept of digital leadership was related to defining emerging digitalization needs and developing strategies, managing and developing technology-based projects, managing corporate relations, and planning and managing digital transformation operations. It has been observed that the project management methodology, which is the professional competence that comes to the fore in the second place, interacts with a more limited job description, and accordingly, it was in intense interaction with the job description of only managing technology-based projects. In this process, the aim of managing customer relations in order to understand the needs of customers for digitalization, collecting and coordinating innovation ideas, and performing data-based studies came to the fore.

✓ **EQF Template:**

Based on all the information gathered, a competencies framework has been developed as part of the project. This framework includes a skills profile that aligns with the European Qualifications Framework (EQF). The EQF is a system for comparing qualifications across different countries and education systems in Europe. The skills profile is designed to represent the specific competencies required for the project and is structured according to the EQF's levels of proficiency. By using this framework, the project team will better understand the skills and knowledge needed to successfully carry out the project's objectives.

Skill/ Competency	Importance Level	Core Skills	Support Skills	Other Related Skills
Project Management Skills	5	✓		
Innovation Management Skills	4	✓		
Digital Literacy (Emerging Tools)	5	✓		
Strategy Development	5	✓		
Ability to Change Management	5	✓		
Digital Leadership, Coordination and Planning	5	✓		
Regularity Informations	4		✓	
Business Development	4		✓	
Team Management	5		✓	
Innovative Thinking	4		✓	
Analytic Thinking	5		✓	
Problem Solving	5		✓	
Communication Skills	5			✓
Data Visualisation	3			✓
Research Skills	4			✓

Figure 4. Indicators of Skills for Digital Transformation Managers. (by Authors)

- **Occupation Description of Digital Transformation Managers**

A Digital Transformation Manager is a professional who is responsible for driving organizational digital transformation processes and innovation by leveraging technology and emerging tools. At EQF 7 level, Digital Transformation Managers are expected to have a comprehensive understanding of business processes and emerging tools such as AI, IoT, RFID, etc., and how they can be used in business processes. At EQF 7 level, Digital Transformation Managers should possess a combination of technical, managerial, and communication skills to lead digital transformation initiatives effectively.

ℹ Level 7

(Qualification Equivalent: MA)

Knowledge(s):

- ✓ Understanding of emerging digital technologies and trends, such as artificial intelligence (AI), blockchain, RFID and the Internet of Things (IoT),
- ✓ Familiarity with data analysis and business intelligence tools and techniques (especially big data)
- ✓ Knowledge of digital businesess strategies and techniques,
- ✓ Awareness of project management, risk management and cost management strategies,
- ✓ Knowledge of organizational change management principles and techniques,
- ✓ Knowledge of peoplme management and HR management techniques.
- ✓ Knowledge of legal regulations related to digital transformation (data protection etc.)

Skill(s):

- ✓ Digital leadership skills to inspire and motivate teams to adopt digital technologies and processes,
- ✓ Ability to identify and manage risks and issues associated with digital transformation projects
- ✓ Excellent communication and interpersonal skills to collaborate with stakeholders at all levels of the organization,
- ✓ Ability to measure digital maturity and prepare a transformation strategy,
- ✓ Strong analytical and problem-solving skills to assess business requirements and design digital solutions.

Competencies:

- ✓ Strategic thinking and ability to align digital transformation initiatives with organizational goals and objectives,
- ✓ Entrepreneurial mindset to identify new business opportunities through emerging technologies,
- ✓ Flexibility and adaptability to quickly respond to changing business requirements and emerging digital trends,
- ✓ Continuous learning and improvement mindset to keep up with evolving digital technologies and best practices,
- ✓ Customer focus and ability to develop customer-centric digital solutions that meet their needs and expectations.

Additional Indicators on the "Green Transformation" axis:

Knowledge(s):

- ✓ Knowledge of sustainability principles, tips and concepts, including circular economy, eco-design, and life cycle assessment,
- ✓ Familiarity with emerging green technologies and trends, such as renewable energy sytems (solar enegy, wind energy sytems etc.)
- ✓ Knowledge of mesurement and monitoring of circular economy strategies,
- ✓ Understanding of stakeholder engagement and communication strategies for sustainable business practices,

Skills:

- ✓ Ability to develop and implement green digital transformation strategies that align with businesess circularity,
- ✓ Strong analytical and problem-solving skills to identify opportunities for sustainability improvements across the organization,
- ✓ Project management skills to effectively plan, monitor and control green digital transformation initiatives,
- ✓ Ability to measure and report on sustainability performance indicators and develop sustainability report

Competencies:

- ✓ Transformative mindset to identify new business opportunities through green digital technologies and innovations,
- ✓ Flexibility and adaptability to respond to changing sustainability requirements and emerging green trends,
- ✓ Continuous learning and improvement mindset to keep up with evolving sustainability practices and technologies,
- ✓ Ability to inspire and motivate teams to adopt green digital technologies and processes.

The primary responsibility of a Digital Transformation Manager at EQF 7 level is to design and execute a digital transformation strategy that aligns with the organization's overall objectives and KPI targets. They should be able to identify opportunities for innovation and improvement and collaborate with internal and external stakeholders to create a roadmap/strategy for implementation. This requires a deep understanding of the organization's business processes and technology systems, as well as the ability to analyze data and identify technology trends and tips. Digital Transformation Managers must also possess strong leadership, especially digital leadership, and communication skills to manage teams effectively and drive change across the organization. They should be able to communicate technical concepts to non-technical stakeholders and manage relationships with external vendors and partners. Additionally, they should have experience in project management, including the ability to define project scope, timelines, and budgets, and track progress against established goals.