Exploring Digital Transformation in German Mittelstand to Identify and Advance Future Key Competencies from a strategic Human Resource Management Perspective

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A Grounded Delphi Study

Inga Knoche

2022

University of Worcester

‘Everybody's got a different way of telling a story - and has different stories to tell. ’

- Keith Richards -

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Declaration

I, Inga Knoche declare that the work in this thesis was carried out in accordance with the regulations of the University of Worcester and is original except where indicated by specific reference in the text. No part of the thesis has been submitted as part of any other academic award. The thesis has not been presented to any other education institution in the United Kingdom or overseas. Any views expressed in the thesis are those of the author and in no way represent those of the university.

Signed:

Date: 18th July 2022

Abstract

A growing use of digital technologies leads to new business models and changed ways of working, this also entails strategic, cultural and process-related changes in organisations. These dynamic and complex changes place new demands on people in organisations. A growing body of current research is already focusing on these new requirements and the dynamic interplay of several aspects of digital transformation in organisations. Initial research from the perspective of strategic human resource management (SHRM) focuses on these new work situations. So far, however, there is a gap in theory and practice regarding the future competencies of German Mittelstand (GM) for the digital transformation, especially with regard to the clarity of which competencies these are and how they can be advanced. This is especially relevant for the consideration from a SHRM perspective, as companies of GM usually do not have these resources in the area of SHRM. Therefore, the aim of this research is to close the gap and to understand the digital transformation in German Mittelstand and, based on this, to identify the required future key competencies and to develop insights into the advancement of these key competencies from a SHRM perspective. A qualitative research design under the social constructivist paradigm with an explorative and inductive approach was adopted to address this gap. The Grounded Delphi Method (GDM) was used to generate knowledge and forecast the key competencies required in GM in the future. The results of the two round GDM led to a deep data base and insights for the study. The findings show that a strong change in work is to be expected in the Mittelstand due to the further integration of digital technologies. This will result in future key competencies, which above all demand more responsibility from each individual and increasingly require emotional and social competencies as well as some personality-based characteristics. In GM, the owner in particular is a central driver for further development. To progress this, a model was developed that complements the findings in a SHRM model to understand the different elements that influence the future competencies of people in the digital transformation in context to enable measures to advance competencies in GM companies.

Keywords: *Digital Transformation, German Mittelstand, Future Competencies, Strategic Human Resource Management, Grounded Delphi Method*

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This dissertation is dedicated to my wonderful parents,

for their endless love, support, and trust!

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Abbreviations

AI	-	Artificial intelligence
ArbSchG	-	Arbeitsschutzgesetz (Occupational Health and Safety Act)
BfJ	-	Bundesamt für Justiz (Federal Office of Justice)
BMWi	-	Bundesministerium für Wirtschaft und Energie (Federal Ministry for Economic Affairs and Energy)
BPR	-	Business Process Reengineering
BVMW	-	Bundesverband Mittelständische Wirtschaft (Federal Association of Small and Medium-Sized Businesses)
DBA	-	Doctor of Business Administration
ECS	-	Enterprise collaboration Systems
EU	-	European Union
GDM	-	Grounded Delphi method
GM	-	German Mittelstand
HGB	-	Handelsgesetzbuch (German Commercial Code)
HRM	-	Human Resource Management
ICT	-	Information and communication technologies
IfM Bonn	-	Institut für Mittelstandsforschung Bonn (Institute for SME Research Bonn)
IS	-	Information Systems

JCI Germany	-	Junior Chamber International Germany (Wirtschaftsjunioren Deutschland)
NCREL	-	North Central Regional Educational Laboratory
PEST	-	Political, economic, social and technological factors
PIS	-	Participant information sheet
RO	-	Research Objective
RQ	-	Research Question
SHRM	-	Strategic Human Resource Management
SMEs	-	Small and medium sized businesses

1. Introduction

1.1 Brief Overview

Digital technologies can be found in almost all areas of daily life; as such, they are also increasingly influencing companies and the work occurring within these companies. The increased use of digital technologies, as well as associated changes in work within companies of nearly every type and size, is placing new demands on employees, who must develop new skills and competencies adapted to the circumstances to ensure the company's competitiveness and business growth, on the one hand, and to cope as individuals in the changing and complex working world shaped by digital innovations, on the other (Fonseca and Picoto, 2020; Osmundsen, 2020; Kocak and Pawlowski, 2021). The profound changes that organisations are undergoing and must adopt as a result of digital technologies are collectively referred to as the 'digital transformation' (Kocak and Pawlowski, 2021). Given the extent of the changes caused by such a digital transformation, a steadily growing proportion of research is, unsurprisingly, being conducted in this area. This also applies to the focus on the necessary and important competencies for this changed work in the future. However, findings focusing on key competencies for digital transformation remain limited (Kocak and Pawlowski, 2021); existing research focuses heavily on technologically oriented capabilities or the examination of future competencies in a specific industry, region or job role (Osmundsen, 2020; Kocak and Pawlowski, 2021). A general lack of research exists on how best to foster future key competencies when change is fast and continuous. This gap affects German Mittelstand (GM) in particular. GM is considered to be small and medium-sized enterprises that have special characteristics, such as the unity of ownership and management as well as a socially created and recognised self-image as the backbone of the German economy. The unity of ownership and leadership ascribes a special role as decision-making role models to leaders. In addition, due to the size and structure of these organisations, there is often no dedicated strategic unit responsible for human resources (HR) development, or HR in general, which can make measures and adjustments less structured or controllable against the background of a constantly advancing digital transformation and new demands on people. The construction of an understanding of future competencies under

the described characteristics of GM is therefore important to develop possibilities for strategies for organisations in GM based on this understanding.

This research addresses these gaps through a qualitative approach by exploring the digital transformation in GM to understand the phenomenon and its influences and, based on this, to identify which future key competencies are needed and how they can be advanced in GM from a strategic human resource management (SHRM) perspective. In this first chapter, the context and background of the research is presented to demonstrate the purpose and significance of this study and outline the resulting objectives, research goal and central research question (RQ). The methodology and research design chosen for this purpose are further described. Finally, the structure of the thesis is presented.

1.2 Setting the Scene for the Research

1.1.1 Background and Context

The use of digital technologies and continuous progress in the development of these technologies is indispensable for improving competitiveness (Eurostat, 2022). This is underlined by a 2021 European Commission study showing that the majority of European Union (EU) businesses employ a significant deployment of information and communication technologies (ICT) in various forms, as shown in *Figure 1-1*.

The use of digital technologies affects all areas of an organisation, concerning the services offered and their production, as well as all processes and the types of communication and work (Eurostat, 2022). The profound changes in organisations driven by digital technologies—the digital transformation—are therefore complex (Kocak and Pawlowski, 2021). Understanding this integral effect of technologies, processes, the organisation of the organisation and the human dimension enables economic progress in extremely short intervals (Fonseca and Picoto, 2020). At the same time, however, this potential presents organisations with major challenges in identifying the measures and capabilities needed to master the digital transformation (Osmundsen, 2020); these challenges are particularly evident in relation to the design of work and the identification of the necessary skills and competencies for people (Osmundsen, 2020; Collings et al., 2021).

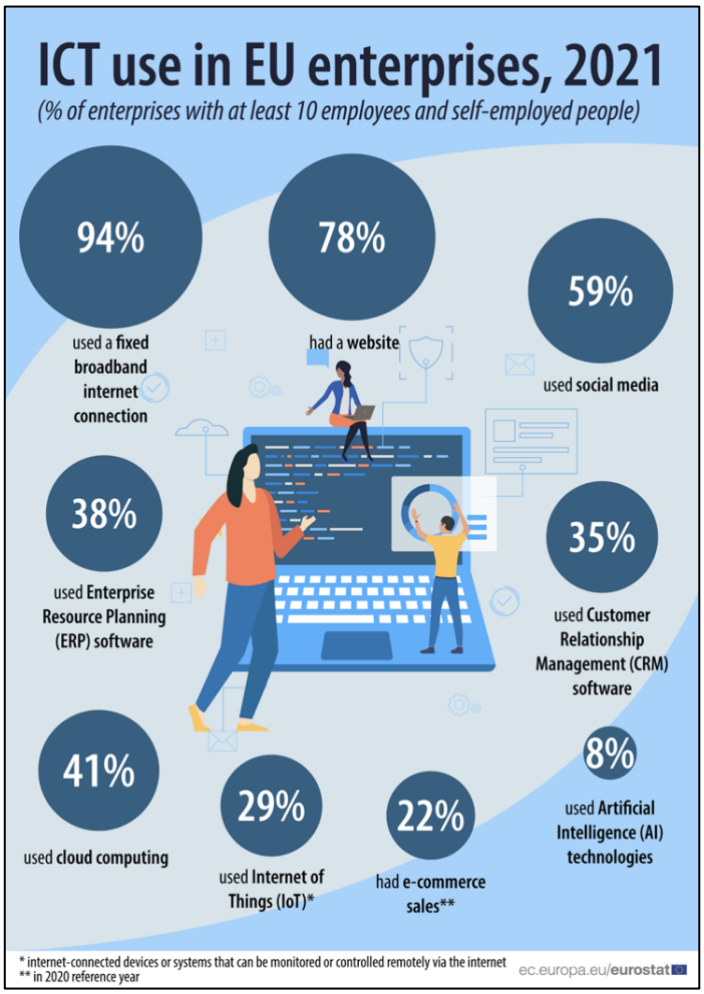

Figure 1-1: Use of digital technologies amongst European Union enterprises (Eurostat, 2022).

With the focus on changing ways and forms of work, the COVID-19 pandemic has also further accelerated the use of digital technologies. Collings et al. (2021) aptly state that the pandemic 'forced organisations around the world to adapt the organisation of work and the design of workplaces' (Collings et al., 2021, p. 2). This also applies to GM, which is a unique construct worldwide (Welter et al., 2015). The Mittelstand's uniqueness relates to the unity of ownership and leadership, which gives the person or persons who are the "owners" a special role for decisions of any kind (Becker, Staffel and Ulrich, 2008; Welter et al., 2015). With the focus on Mittelstand, it becomes especially clear that digitalisation efforts in smaller organisations have primarily served crisis management and have often been less strategic (Amerland, 2021). However, due to increases in the use of digital strategies to secure competitiveness, as described above, in the future, the same developments as in larger organisations can be assumed to occur in smaller ones as well. This delay may explain why scientific findings are

lacking, especially for the Mittelstand. Furthermore, the structure and size of Mittelstand companies also means that strategic decisions are made increasingly by owners and less often by the relevant specialist departments, such as in the area of human resource management (HRM), which makes adaptable findings for such decision-making processes necessary.

In addition to the influence of digital technologies on all processes within organisations, the increase in pressure with regard to the design of work due to the pandemic and the special features of GM, the question of the necessary skills and competencies for the subject of the study in GM also presents an additional challenge. In the international literature, the term ‘competencies’ is not clearly defined but is generally present as a distinction from ‘competences’ (Hoffmann, 1999; Delamare Le Deist and Winterton, 2005). According to Woodruffe (1991), ‘competences’ describes a functional ability to do something, while ‘competencies’ is broader and additionally includes characteristics of the person who possesses a competence (Woodruffe, 1991, cited in Delamare Le Deist and Winterton, 2005, p. 27). This is not the case in German, which increases the difficulties of adapting the findings on future competencies in a digitally transformed world of work for GM.

The context described above makes it clear that this is a complex field of research which, on the one hand, focuses on the digital transformation and its effects and, on the other hand, places the specifics of GM, in relation to the key competencies that will be necessary in the future, at the core of the question. On this basis, the research problem is defined in the following section.

1.1.2 Research Problem

To remain competitive in the context of increasing digital transformation, it is a critical core element of success that people within organisations have the skills and competencies necessary to shape change and adapt to shifting working conditions (Osmundsen, 2020; Kocak and Pawlowski, 2021). Numerous studies have examined the advancement of competencies in organisations, but in the context of digital transformation, research on which competencies are essential has been limited, as has research on how organisations can advance these competencies amongst their

employees (Shahlaei, Rangraz and Stenmark, 2017; Butschan et al., 2018; Fonseca and Picoto, 2020; Osmundsen, 2020; Kocak and Pawloswki, 2021). This gap also affects GM, where developments in the area of digitalisation are lagging internationally, especially amongst smaller organisations (Amerland, 2021). Internationally developed theories pose problems for organisations from GM. Due to different strategy and management models and different capacities in terms of resources, findings for international or large companies cannot always be directly adopted for the Mittelstand. In addition, the level of development of digital transformation in the Mittelstand is sometimes less advanced than in larger companies, which presents a different understanding of what digital transformation can entail. A first challenge is thus to pinpoint the prevailing understanding of digital transformation in GM to identify those effects that are occurring and those that are still expected in context and subsequently identify future key competencies. This situation leads to the fact that little research has been done on future key competencies for the Mittelstand; as such, a need exists for research efforts on competencies and their advancement in this area (Von See, 2019). As a result, existing research for GM is insufficient, organisations within GM are inadequate in terms of advancing future key competencies, especially against the background that these organisations usually do not have strategic HR efforts and thus possess neither the knowledge about future key competencies for digital transformation nor implementable starting points for advancing these within the organisations. This research addresses this problem according to the research aim, objectives and questions presented below.

1.1.3 Research Aim, Objectives and Questions

The intentions of this research study are to explore digital transformation in German Mittelstand, to understand the phenomenon and its influences within organisations, and based on this, to identify which key competencies will be needed in the future and how they can be advanced from an SHRM perspective. To achieve this aim, this thesis pursues several objectives (ROs):

- ***RO1: To create an understanding of digital transformation, the interdependencies of related areas and the effects on organisations in German Mittelstand.***

- ***RO2: To investigate the future key competencies resulting from digital transformation in German Mittelstand using expert knowledge;*** and

- ***RO3: To provide new insights for advancing the identified future key competencies for digital transformation in German Mittelstand using expert knowledge.***

The following specific research questions (RQs) arise from the ROs:

- ***RQ1: What is the current understanding of digital transformation in German Mittelstand, the interdependencies, the related areas and the impact on the organisations?***

- ***RQ2: What future key competencies will result from the digital transformation in German Mittelstand?***

- ***RQ3: How can the identified future key competencies for digital transformation in German Mittelstand be advanced in the future?***

By answering these three RQs, the research aim is ultimately reached, by answering the overarching question:

- ***How can the identified future key competencies for digital transformation be advanced in German Mittelstand from a SHRM perspective, considering the complex interrelationships and expected developments?***

1.1.4 Research Purpose and Scope

This study contributes to the body of knowledge on SHRM by examining and evaluating future key competencies and their advancement from a complex perspective and identifying approaches for GM. These specific findings help to clarify the changing world of work resulting from digital transformation and new demands on competencies from the perspective of SHRM. This subsequently helps to address the current lack of research in this area and also provides real benefits to GM organisations in such a dynamic environment by developing a comprehensible, modelled approach for the advancement of key competencies which enables their use in practice.

In addition, this study provides an understanding of competencies that have not yet been considered in research on requirements and capabilities in German. In the context of digital transformation, the understanding of and findings on competencies make it possible to initiate appropriate measures in GM and related areas of influence. Due to the focus on GM, the results cannot be adapted to all types of companies. Moreover, the qualitative approach does not allow for a generalisation of the results. Equally, the study provides deep insights and valuable findings for the field of enquiry, which can make a valuable contribution and serve as a starting point for further research.

1.3 Methodology and Research Design

A qualitative research design according to the social constructivist paradigm with an explorative and inductive approach was chosen to fill the identified gaps and answer the overarching RQ. In particular, GM as a socially constructed understanding justified the generation of knowledge under this paradigm. As such, the involvement of representative actors of GM to forecast the expected developments and future needs for key competencies as well as their advancement suggests the use of a forecasting technique. The Grounded Delphi method (GDM) was used to generate knowledge, analyse it in a structured manner and forecast the key competencies needed in GM in the future.

For data collection, an expert panel of 25 participants from GM was assembled, who answered an open-ended online questionnaire in the first round of the study. The data was analysed using the Straussian grounded theory method. Based on the results, statements were formulated which were evaluated in the second round by the same panel of experts as applying to them (or not) and which could additionally be provided voluntarily with hints and comments. The results of these two rounds led to a deep data base and insights for the study.

1.4 Structure of the Thesis

This thesis comprises six total chapters. The second chapter, the literature review, begins by clarifying the concept of digital transformation as a central element of this work, as well as the current state of research on this phenomenon. The relevant

digital technologies are explored afterwards. In the following SHRM is outlined. Since the work focuses on GM, the construct is the subject of the following sub-chapter organisational aspects, which are subsequently supplemented by the exogenous perspective. Against the background of the changes affected by digital technologies in GM companies, organisational components such as work design are also used and presented for this research. The central question of this thesis focuses on the human components and the effects of the digital transformation with regard to the required future key competencies; as such, these are also highlighted in the literature review. Finally, based on the components presented, the literature review highlights the gaps identified. To provide a coherent outline to the complex context and be able to use it for the study design, a conceptual framework is presented that relates all aspects identified in the literature review. In the third chapter, the research methodology and the study design are presented in a structured manner. After pinpointing the research philosophy, the research strategy—the GDM—is described in detail. The third chapter concludes by outlining the role of the researcher and reflections on the quality of research and ethical implications. Considering the chosen research design, the fourth chapter presents the procedure of the data analysis for both rounds of the Delphi study, as well as the development of the questionnaire for the second round, based on first-round data. Finally, the applied GDM is reflected upon. The fifth chapter presents the results of the study. For a clear presentation of the findings, the chapter is divided into the two rounds of the Delphi study. Within each round, the sections of the questionnaires are retained and the emergent codes and categories, as well as an assessment of the statements based on the data, are presented. The final chapter comprises the discussion and conclusion. The results of the study are linked to the existing literature to answer the RQs and achieve the aim of this thesis by showing the contributions the research makes.

2. Literature Review

2.1 Introduction

This chapter presents the literature review and aims to provide an understanding of the scientific fields relevant to the research aim presented in the introduction and the associated ROs and RQs. As the subject area addressed in this paper is broad, findings from different perspectives are considered, differentiated, and used as a basis for one's own knowledge gain sought here. They are based on already researched aspects in the main areas and are limited and critically discussed only to the relevant points (Jankowicz, 2005; Saunders, Lewis and Thornhill, 2009).

To meet this requirement, a narrative literature review was undertaken. The advantage of this approach is explained by the novelty as well as the divergence of the topic area (Bolderston, 2008). Little comparable evidence exists to date in this emerging area of research. At the same time, there is a great wealth and constantly growing amount of research, so it is important to be able to continuously consider current publications during the processing of this thesis. The narrative approach thus makes it possible to conduct a comprehensive analysis of the relevant contributions without having to consider and commit to guidelines—as is the case with the systematic approach (Ferrari, 2015). In addition, it is possible to address multiple questions—as required for this work—in the selection of literature. These advantages outweigh the well-known weaknesses of the narrative literature review approach, that the selection of literature is biased by the subjectivity of the researcher (Ferrari, 2015).

To approach the complex field of action of this work, a relevance tree was used to select the components of the existing research fields to be considered. The arrangement of the relevance tree is based on the principle from the general to the specific, in this case from the overarching question or topic of the study, via the relevant sub-areas and therein again to specific areas of a field (Hart, 2018). The relevance tree was primarily used at the beginning of the literature review to enable the delimitation of areas that are not necessary for the achievement of the goal and, in the case of complex topics, to ensure that all essential aspects and their interrelationships are addressed (Saunders, Lewis and Thornhill, 2009; Hart, 2018). Although the weakness of relevance

trees is well known, that the selection of themes and topics and potential impacts may not be based on sound reasoning (Porter et al., 1980), this approach was chosen due to the complexity of the field and the multitude of facets to be included as well as their interactions, and allowed for a structured overview of the field in the literature review through the graphical representation of relevant topics (Manuel and Pretorius, 2013).

The selection of the core topics was derived from the RQ. Thus, the areas of "Digital Technologies", "German Organisations" and "Organisational Change" formed the starting point for the relevance tree and the further research of the components. On the one hand, the further selection of literature was based on this. On the other hand, the selection and elaboration of the existing literature was determined by the conceptual framework, which is presented in subchapter 2.2.3. A conceptual framework - also called conceptual mapping (Hart, 2018) - is used to represent the main concepts and their relationships to each other, in a particular context or situation (Miles and Huberman, 1994; Hart, 2018). The conceptual framework, which is the result of this literature review, was developed in an iterative process during the literature review and was based on the literature that was initially selected and sorted using the relevance tree, and put into a dynamic context for the research problem under discussion within the conceptual framework. The iterative process of the literature review was thus guided by the relevance tree and the conceptual framework. *Figure 2-1* shows the relevance tree that underpins this literature review. The aspects considered in the literature review are shown in light blue boxes, while the white boxes symbolise topics that are not relevant to this work and thus not part of the literature review.

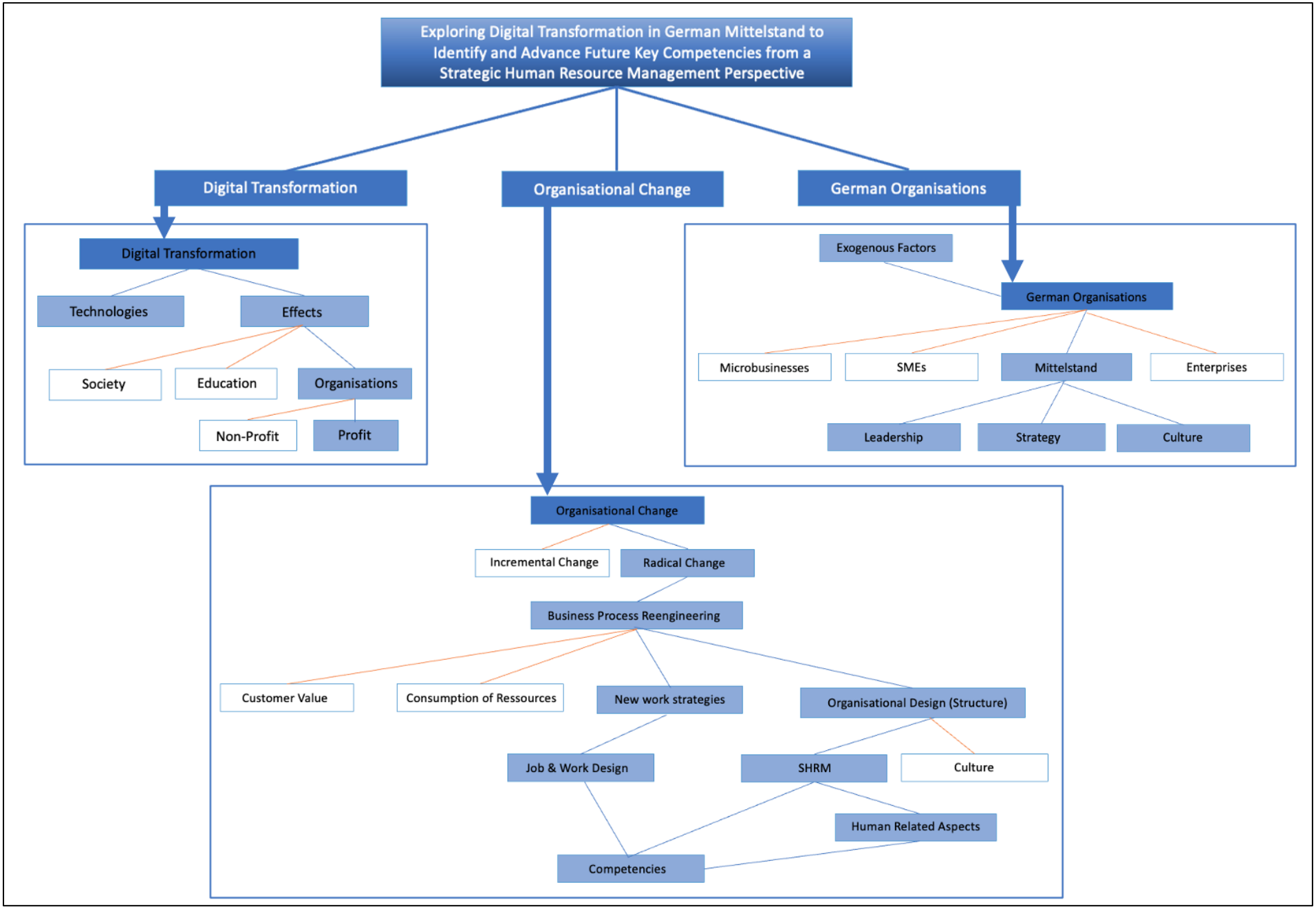

Figure 2-1: Relevance tree for literature review.

The literature review comprises a total of six sections. This section introduces the literature review, and Section 2.2 presents a discussion of the terms ‘digitisation’, ‘digitalisation’ and ‘digital transformation’ and concludes with a model of the areas of impact of digital transformation, in Sub-section 2.2.3. The model introduced there forms the basis for the further structuring of the literature review. Section 2.3 explains the digital technologies that will influence future work in organisations. Following this, Section 2.4 places the relevant organisational aspects at the core of the review. This part is divided into two perspectives—endogenous and exogenous—and concludes with an examination of concepts regarding the organisation of work in the context of technological influences. As a further elementary component, the human aspects are discussed in Section 2.5 and placed in the context of this work. Finally, the previous findings are brought together in Section 2.6. Thus, this final section of the literature review shows the implications of the individual areas for this research, as well as the identified gaps that must be filled with this thesis.

2.2 Digital Transformation — Defining the Terms

2.2.1 Industry 4.0

Due to the increasing use of data-based technologies—especially in industry—the current developments are often collectively referred to as the fourth industrial revolution, or Industry 4.0 (Schwab, 2016; Bauer et al., 2018). This is based on the understanding of the term ‘industrial revolution’, which expresses a rapid change in economic and social structures through the use of new production technologies (Voigt et al, 2019). The first industrial revolution occurred in the late 18th century, with the introduction of machines in factories. This was followed by the second industrial revolution in the early 20th century, with the use of electricity and the introduction of mass production. More recently, during the 1970s, electronics and IT entered production. This marked the beginning of the third industrial revolution. Through the use of computers, it became possible to process previously analogue information into digital information, thus enabling the automation of production (Voigt et al., 2019). Technologies such as mainframes, personal computers and the breakthrough of the internet in the 1980s were drivers of this development phase. Following Janssens’ (2019) description, the fourth industrial revolution should be considered more as a

synonym for digital transformation. Through automation, new technological possibilities and new ways of working and thinking, production areas are often disruptively changed. Especially in industrial production, this current revolution can be observed through the use of mobile computers, cloud-based applications and networking, and the associated exchange of data via the internet. Networking does not end at the borders of production but rather implies not only machines but also customers, suppliers, other factories and products. These changes, also referred to as Industry 4.0, hence comprise the merging of classic production with digital technologies, with the aim of optimising services—over the entire life cycle of products—with the help of data (Bundesministerium für Wirtschaft und Energie [Federal Ministry for Economic Affairs and Energy], 2015; Absenger et al., 2016; Voigt, 2021).

As no generally applicable definition for the term 'Industry 4.0' exists (Ruiner and Wilkesmann, 2016; Hofmann and Rüsch, 2017), Ittermann, Niehaus and Hirsch-Kreinsen (2015) provide the underlying understanding for this work, describing Industry 4.0 as an industrial revolution characterised by intelligent digitalisation and the automation of products and value creation processes. This occurs primarily via the merging of real and virtual production into complex systems (Ittermann Niehaus and Hirsch-Kreinsen, 2015; Bauer et al., 2018).

More important than a precise definition, however, is the differentiation from other terms related to digitalisation. The term 'Industry 4.0' focuses strongly on the areas of production and products. This proximity to industry and the developments in this area have been considered in numerous studies. However, this work focuses primarily on the changes in work and requirements in general through a broader understanding of the phenomenon of digital transformation. In this context, technological achievements in the field of production are included amongst the technological drivers of digitalisation. However, as Bhimani and Willcocks (2014, p. 470) aptly note, 'No aspect of the economy today is untouched by digital technologies'; it would be insufficient at this point to focus only on the area of production.

2.2.2 Digitisation, Digitalisation and Digital Transformation

With technology influencing markets and everyone's working world, the term 'digitalisation' is often used in German. However, this German term has two translations in English ('digitisation' and 'digitalisation'), which are often used synonymously but do not have the same meaning (Brennen and Kreiss, 2014; Bloomberg, 2018; Warner and Wäger, 2019). To enable a clear understanding of the terms used in this thesis, these two terms are first defined and delimited in this section.

The term 'digitisation' describes the use of computers in production, as outlined in the context of the third industrial revolution and is thus not a current phenomenon. Following the opinion of Bloomberg (2018, p. 1), who uses the definition from the Gartner IT Glossary, 'Digitisation… is the process of transforming analogue into digital form' (Gartner, 2020b). Almost identical is the definition in the Oxford English Dictionary (OED), which defines digitisation as 'the act or process of digitising; the conversion of analogue data (especially in the subsequent use of images, video, and text) into digital form'. One of the most popular and common definitions comes from Brennen and Kreiss (2014), who define 'digitisation as the material process of converting individual analogue information streams into digital bits'.

Based on the definitions presented and the explanations of i-SCOOP (n. d.a), this work assumes the following understanding of digitisation:

> Digitisation is the process of transforming analogue into digital form by digitising existing manual and paper-based processes from an analogue to a digital format or the digital representation of a physical object, with the aim of digitising and automating processes or workflows.

As mentioned above, the terms 'digitisation' and 'digitalisation' are often used interchangeably and are not clearly separated or defined. Gobble (2018) aptly notes that despite there being only a two-letter difference, 'the difference in meaning and impact is enormous' (Gobble, 2018, p. 56). The definition used by Gobble is that 'digitalisation…

refers to the use of digital technology and probably digitised information to create and harvest value in new ways' (Gobble, 2018, p. 56).

The connection to digitisation is also reflected in the definition of Gartner (2020a), which states that digitalisation is a continuation of the term digitisation, as it also describes the use of digital technologies. At the same time, however, according to the definition, a change in business model also occurs (Gartner, 2020a). This understanding of the term is also shared by Gobble (2018), who states that digitalisation brings new business models and strategies and that disruption and innovation change the business itself (Gobble, 2018). According to Gobble (2018), sensors on a machine that send information to a worker are still part of digitisation; only when 'this transmitted data is used to predict and prevent breakdowns, optimise planned maintenance schedules, and improve the product is that digitalisation' (Gobble, 2018, p. 57). According to Bloomberg (2018), automation is at the core of digitalisation. Bloomberg's comments already include some implications that relate not only to business processes but also to people's work roles (Bloomberg, 2018).

The aspect of increasing interaction and communication is reflected in the definition of Brennen and Kreiss (2014), who 'define digitalisation in terms of digital communication and the impact of digital media on contemporary social life' (Brennen and Kreiss, 2014). While Brennen and Kreiss limit their understanding of the term to one's social life, Benner (2017, p. 2) also speaks of the 'integration of digital technologies into the everyday life of all things that can be digitised'.

Based on the previous descriptions, the following definition of digitalisation is used for this work:

> Digitalisation is the continuation of digitisation. Digital technologies are used to implement new business models and new strategies in organisations. Most critically, a large amount of data is used to inform processes and thus optimise and automate them. Interaction with technologies is changing working life, collaboration and intervenes in people's entire lives through new products and services.

Digital transformation is characterised by the fact that the immense influence of digital technologies cannot be explained by changes in individual areas alone. Rather, it is a phenomenon that significantly impacts interactions between people in general. The understanding of digital transformation thus goes much further than that of digitalisation (Bloomberg, 2018; Hess et al., 2019). The former is a combination of factors, such as various innovations and new technologies, that bring new rules, new requirements and new values to organisations, entire industries and people (Krimpmann, 2015; Loebbecke and Picot, 2015; Mangematin, Sapsed and Schüßler, 2014, cited in: Hinings, Gegenhuber and Greenwood, 2018). Digital transformation is complex and impacts all parts of an organisation and, most importantly, its people. It changes business models, products and processes, as well as the culture and structure of people's working lives (Hess et al., 2019; i-SCOOP, n. d.b). 'Digital transformation describes a sometimes extended change process that can have multiple goals' (Gobble, 2018, p. 57).

This deep influence in all areas causes a cultural change in work in many places, which is thus characteristic of digital transformation (BMWI, 2015; Osmundsen, 2020). The understanding of the term 'digital transformation' underlying this work is therefore based on the definition of i-SCOOP (n. d.b):

> Digital transformation is the cultural, strategic, organisational and operational change of an organisation, industry or ecosystem through an intelligent integration of digital technologies and processes across all levels and functions. This dynamic change requires organisations and individuals to constantly adapt their skills and interactions to rapidly changing conditions.

In summary, for the purposes of this paper, important insights can be drawn from this understanding of the terms 'digitisation', 'digitalisation' and 'digital transformation'. Firstly, the vagueness of the terms requires a close examination of existing research, so a clear demarcation must made from the onset of this work in this

research field to enable existing findings and studies in relation to one's own research field. Secondly, it must be precisely defined for which field of impact the underlying understanding is being considered.

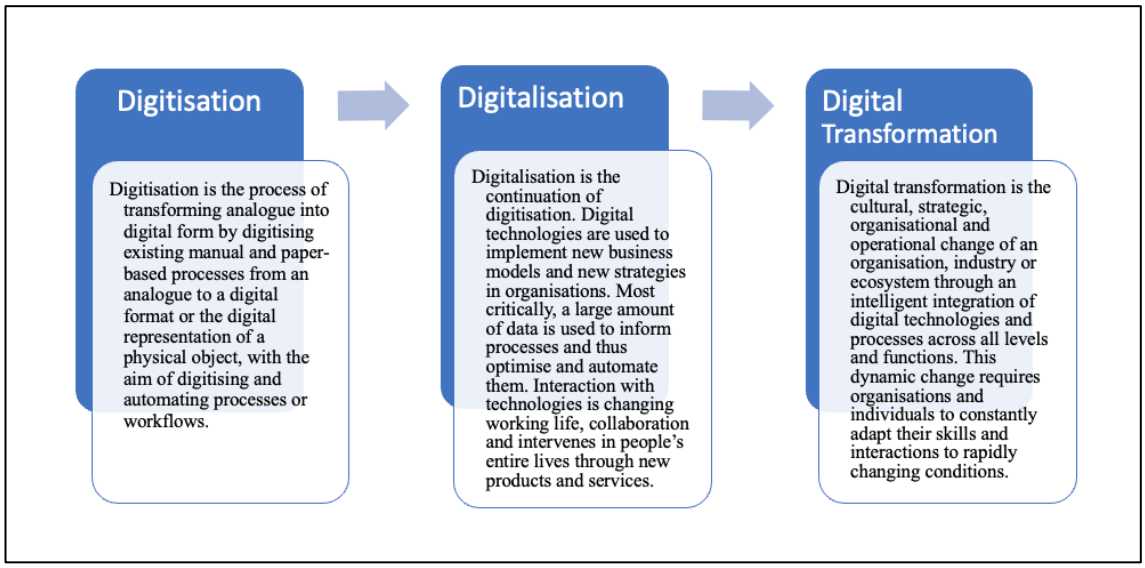

Figure 2-2: Differentiation between digitisation, digitalisation and digital transformation.

To meet this requirement for this thesis, the definitions developed in this section are therefore authoritative. *Figure 2-2* presents the delimitation of the three terms, which forms the basis for the further course of the thesis.

2.2.3 Research on Digital Transformation

Not least due to the COVID-19 pandemic, the interest in and necessity of using digital technologies in the context of cooperation and collaboration has recently gained further momentum (Collings et al., 2021). Due to the necessary protective measures in the context of the pandemic, a large increase has occurred in decentralised work and thus the use of digital technologies. However, the phenomenon of digital transformation has also become the focus of academic research before the outbreak of COVID-19 (Collings et al., 2021; Kocak and Pawlowski, 2021). The diversity of the understanding of the term described above derives from some papers referring to digital transformation but examining digitalisation. This fact often makes it difficult for not only researchers but also interested practitioners to find valid results and thus usable approaches for business practice (Kocak and Pawlowski, 2021). The conceptual understanding on which this thesis is based has been sufficiently explained in the previous section. Based

on this, this section adopts selected current works as a basis for locating the digital transformation in the concrete field of action of an organisation. Due to the complexity and differing interpretations of the phenomenon, a detailed literature review of research in the context of digital transformation is not helpful in answering the underlying RQ. However, to do justice to the goal of citing existing findings, reference is made here to the current overview of the state of research on digital transformation by Verhoef et al. (2021) in the *Journal of Business Research*. Their elaboration on the phases of digital transformation is based on a structured review of the literature on digitisation, digitalisation and digital transformation since 2000. Although the definition of 'digital transformation' used there does not correspond to the one on which this research is based, their result is a comprehensive picture of this complex field, thanks to the multidisciplinary approach. Verhoef et al. (2021) do not concretise the fields of impact on relevant levels within and outside an organisation. At the core of their model, shown in *Figure 2-3*, is the external influence of digital technologies and the change in business processes; the aspect of people and the associated requirements in the changing world of work is not considered. However, it is interesting that the presentation of the change in phases considers the fact that there is a great dynamic that goes hand in hand with digital transformation. In addition, the external influences of digital technologies, digital competition and the resulting consumer behaviour are clearly presented.

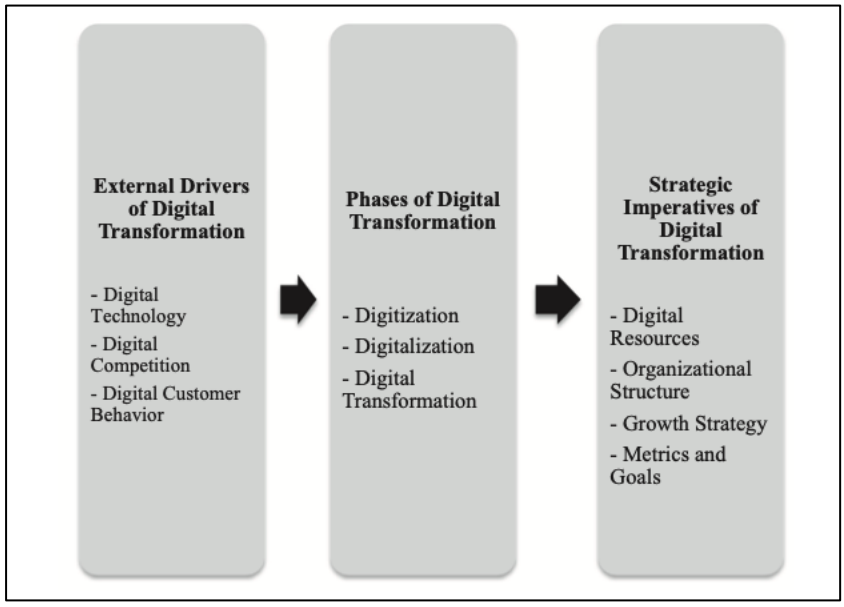

Figure 2-3: Flow model of the discussion on digital transformation (Verhoef et al., 2021, p. 890).

Verhoef et al. (2021) do not however address the internal (in the further course named endogenous) drivers, like people, organisation and processes or leadership, which, according to the researcher, also influence change in the context of digital transformation and must therefore be considered (Hess et al., 2019; i-SCOOP, n. d.b). This claim is addressed by another current research work in the field of digital transformation. In her dissertation, Von See (2019) develops an action framework for digital transformation in value networks. In it, both exogenous and endogenous drivers of change are cited. Additionally, the human component is also considered in the impact context in the framework presented. The human dimension is linked to technology and organisation and thus forms a 'socio-technical triangle of digital transformation' (see *Figure 2-4*).

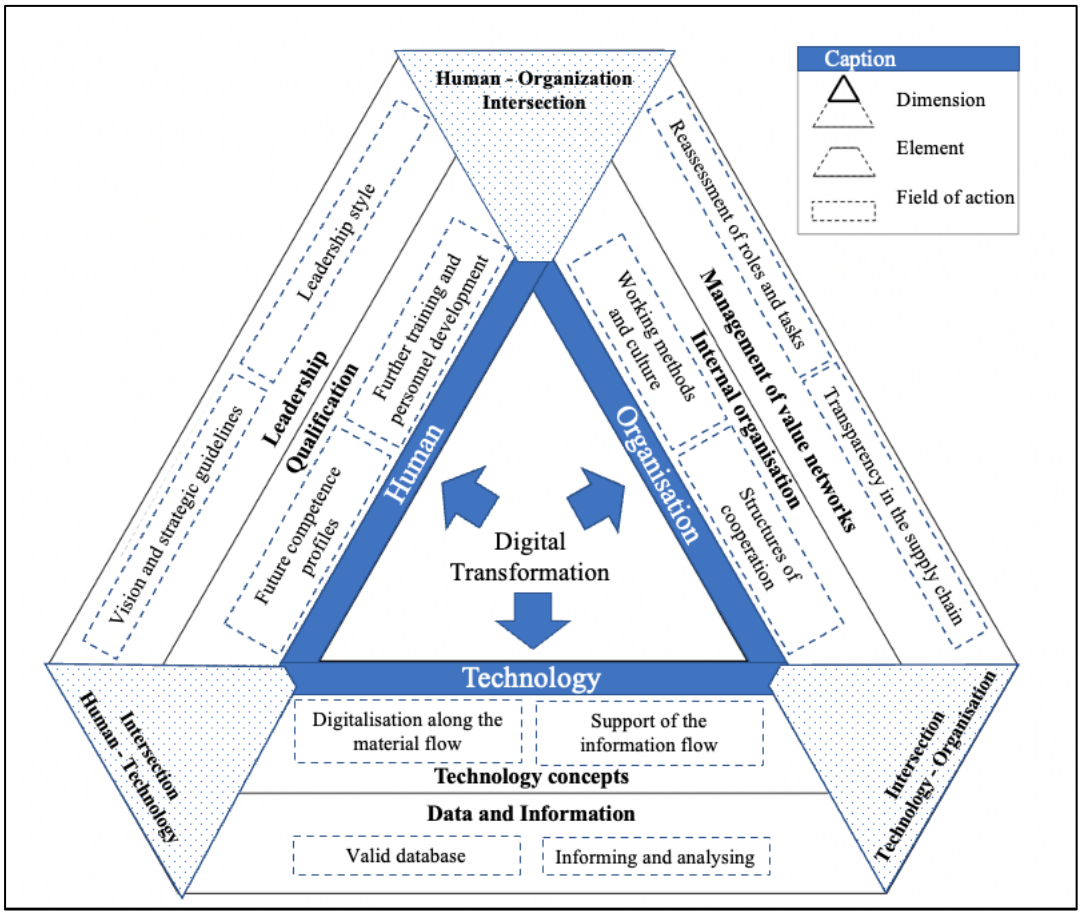

Figure 2-4: Socio-technical triangle of digital transformation — A framework for action (Von See, 2019, p. 84).

Von See's view that the acquisition of necessary new competencies and qualifications is an essential feature of digital transformation also corresponds to the

understanding of this thesis. Similarly, this aspect is not elaborated in depth, so it is excluded as a limitation of her research, and at the end of the thesis, it is recommended '… to make the human dimension or the competences of employees a particular focus of future research efforts due to their proven influence on the adaptability to change drivers' (Von See, 2019, p. 167).

In Foerster-Metz et al. (2018), the dimensions defined by Von See (2019) can be similarly found in the context of the implications of digital transformation for organisational behaviour. With the aim of placing the hitherto under-researched perspective on organisational behaviour in the focus of the elaboration, effects on leadership and employees are examined. The model considers the dimensions of people, structure and technology and refers to the external and internal environments of an organisation. *Figure 2-5* outlines the factors influencing organisational behaviour following Foerster-Metz et al. (2018).

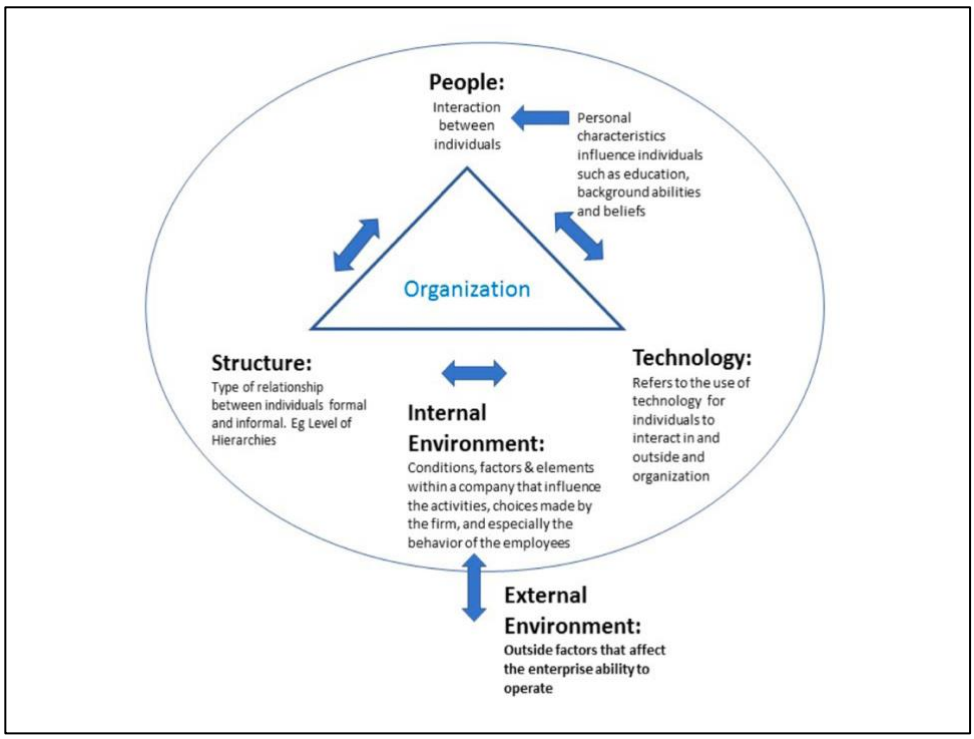

Figure 2-5: Factors affecting organisational behaviour (Foerster-Metz et al., 2018, p.2).

The definition of 'digital transformation' from the previous section has underlined the essential fields of action relevant for this research. Although the existing literature highlights key components in the area of digital transformation, no existing

model can be used as a basis that meets the requirement of completeness for this work, because they lack at least single aspects from this context. To close this gap, a model is developed based on the approaches presented which combines the fields of action of digital transformation for companies in the German Mittelstand sector in terms of the complexity and dynamics of this phenomenon. *Figure 2-6* shows the developed conceptual framework.

In the centre there are the internal factors that are individual to each organisation, referred to as 'endogenous influences' in hereafter; these include the strategy, values, culture, and leadership in an organisation, in this case, in GM organisations. Around this core are three parts; the areas 'technology', 'organisation' and 'humans' are those that affect the phenomenon of digital transformation in an organisation. The three areas intertwine and influence each other. New technologies lead to changes in the organisation. Likewise, new technologies influence every individual in the company in terms of the required competencies, as well as the motivations of an organisation changed by new technologies. Further, concrete examples for these effects can be provided.

External (further also referred to as exogenous) factors, such as market pressure through new demands on competitiveness, new technologies used by suppliers or customers in the value chain, and the generally increasing dynamics and complexity of the environment, also have an impact on the endogenous factors, the digital technologies, the organisation and the humans within an organisation. In addition, legal regulations further influence the design of work as a requirement for organisational management. Exogenous influences are always evaluated and addressed from the endogenous perspective of those responsible in an organisation.

The type of presentation is chosen as a circle, as the interplay of determinants is a constantly moving process. The areas of 'digital technologies', 'organisation' and 'human' comprise both overlapping and interlocking concepts. If one area grows disproportionately—in the sense of progress/development—the dynamic construct becomes out of balance.

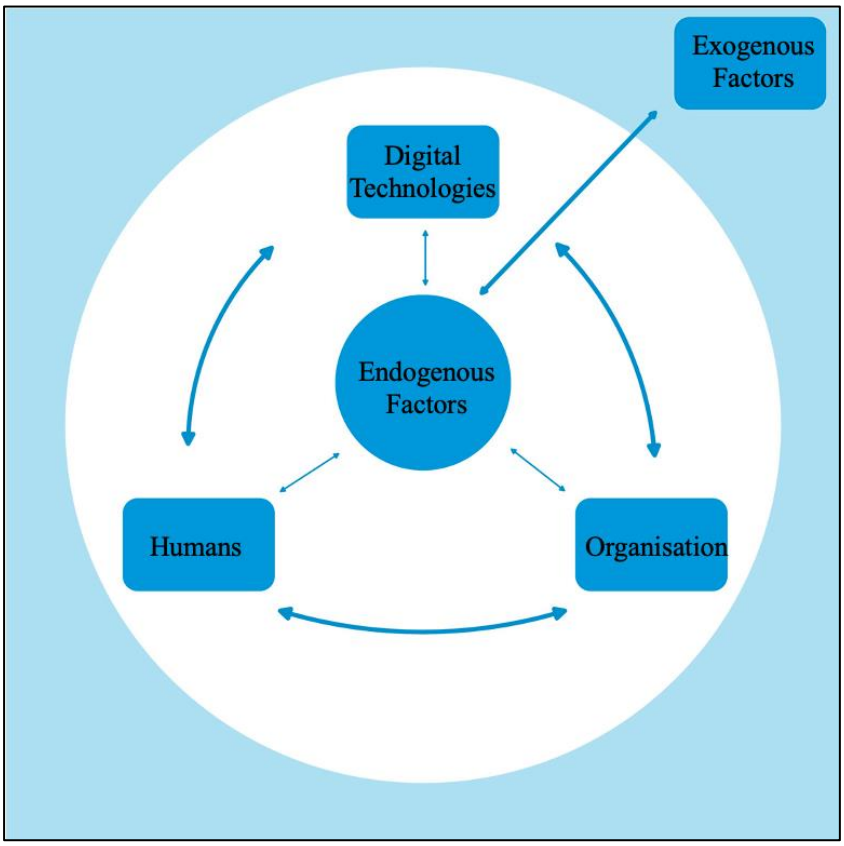

Figure 2-6: Determinants of digital transformation in German Mittelstand companies.

The literature review is therefore structured based on the narrowing down of the literature through the methodology of the relevance tree and the findings on research around digital transformation from this section, leading to the conceptual framework shown in *Figure 2.6*, where the "Determinants of digital transformation in German Mittelstand" are presented. *Table 2-1* outlines the sub-areas of the components of the framework which are considered in the literature review and addressed in subsequent sections.

Table 2-1: Sections and areas of determinants.

Digital Technologies	• Big Data • Hyperconnectivity • Collaboration • Artificial intelligence (AI)	Section 2.3

Endogenous Perspective	• Strategic human resource management
	• German Mittelstand
	  ○ Characteristics
	  ○ Leadership, strategy and culture
		Sub-section 2.4.2

Exogenous Perspective	• Competition and market • Political, economic, social and technological influences • Legal requirements	Sub-section 2.4.3

Organisation	• Business process reengineering
	• Job design
	  ○ Theoretical overview
	  ○ Socio-technical approaches
	  ○ Current approaches
		Sub-section 2.4.4

Humans	• Human-related aspects • Competencies • Research on competency identification in context of digital transformation	Section 2.5

As such, the areas to be considered are highlighted in the course of the literature review, where they are complemented and delineated by relevant current research.

2.3Digital Technologies

2.3.1 Big Data, Hyperconnectivity and Artificial Intelligence

The field of digital technologies is very broad and, in many areas, still eludes public knowledge of its existence, and even more so, the possibilities it offers. Yet, many people already have contact with many of these technologies in their private and professional lives (Schwab, 2016). To structure what follows, three areas are highlighted and discussed that impact the world of work in GM in the context of this thesis. The delimitation of these areas is not easy, as a complete separation around complex digital technologies is difficult. Thus, the areas of Big Data, hyperconnectivity and artificial intelligence are both presented in a structured manner, and their

interrelationships and dependencies are also explained.

Big Data

Sub-section 2.2.2 has explained the influence of ‘data’ on current developments in the field of digitalisation. The large amount of data generated by increasing networking and the heavy use of technologies together comprise a current megatrend, under the term ‘Big Data’. A comprehensive, structured literature review by De Mauro, Greco and Grimaldi (2016) aims to develop a convincing definition of the term and defines ‘Big Data’ as ‘the information value that is so high in terms of volume, velocity and variety that its transformation into value requires specific technologies and analytical methods (De Mauro, Greco and Grimaldi, 2016, p. 131). Undoubtedly, computers (physical or virtual machines) are also involved, providing the computing power to collect and analyse the data (De Mauro, Greco and Grimaldi, 2016). In particular, the analysis of data within an organisation—but increasingly also from sources outside the company itself—makes it possible to incorporate far-reaching insights from various sources into the evaluations. The costs incurred for external knowledge are reduced by using this technology (Niebel, Rasel and Viete, 2019). Examples of external data can also be found within individual companies, such as mobile devices that send information back to the provider. Other drivers include sensors on machines, networked machines and devices, and an exponential increase in data and information processed in different places (Chen, Chianig and Storey, 2012; Niebel, Rasel and Viete, 2019).

Hyperconnectivity

Another technological driver of digitalisation is directly related to the growth of data and the constant availability of information. Communication and collaboration between people and machines will become increasingly interwoven—not only in production but in all areas of a company (Fredette et al., 2012; Arntz et al., 2016a). In this study, this interconnectedness is summarised under the term ‘hyperconnectivity’. For example, smartphones are small mini-computers that have access to the internet and are constantly carried with individuals. In addition to the aspect of mobility, smartphones above all fulfil the uninterrupted connectivity and associated accelerated

development of communication, in both private and professional environments (Fredette et al., 2012).

In the corporate environment, this is referred to as enterprise collaboration systems (ECS). ECS combines classic components of collaboration tools, such as email, document storage systems, scheduling and planning tools with components from (private) social media. These include personal profiles, blogs, comment and similar functions, links and wikis. The goal is to achieve improved collaboration within organisations and ultimately broad knowledge-sharing through more communication and interaction (Li et al., 2012; Greeven and Williams, 2017). However, Li et al. (2012) argued that small and medium-sized enterprises (SMEs) do not have the financial resources to implement these so-called social collaboration platforms. This circumstance has changed massively in recent years. The user-based, monthly licensing of cloud services makes it possible for even small companies to use standard, established platforms for corporate collaboration (Fredette et al., 2012). Direct interaction—or interaction by phone—within a company is shifting communication behaviour to chat messages or articles in news streams. The rapid acceleration of information dissemination and associated increase in transparency has implications for the interaction and accountability of all employees (Polaschek et al., 2012; Greeven and Williams, 2017).

Hyperconnectivity is accompanied by effects that overcome boundaries of interaction, such as time and place; because rich information is always available and easily accessible, these constraints no longer exist. Interestingly, this connectivity is not limited to human–human interaction (even if it is digital). Human–machine or machine–machine communication is also characterised by hyperconnectivity. This, in turn, is made possible, amongst other factors, by the collection and processing of huge amounts of data and the use of artificial intelligence, which is discussed in more detail below (Fredette et al., 2012).

Artificial Intelligence

There is no universal and current definition of artificial intelligence (AI) as it is constantly evolving (Duan, Edwards and Dwivedi, 2019; Hackenberger, 2019). However, AI can be understood as the abilities of a machine that learns through information, data and pattern recognition and can perform human-like tasks. This differs from natural intelligence, which is innate to organisms (Duan et al., 2019; Hackenberger, 2019). The rapid development of large computing capacities and Big Data is accelerating the availability and performance of AI (Schwab, 2016; Lu et al., 2018; Duan, Edwards and Dwivedi, 2019). Similarly, the success of AI is highly dependent on the quantity and quality of the data fed into it, as well as on the processing of this data (Hackenberger, 2019). The underlying technological components are speech recognition, speech generation and natural language processing, augmented and virtual realities, visual recognition, automated decision-making, robotic process optimisation, deep learning platforms and pattern recognition, as well as hardware optimised for AI (Schwab, 2016; Lu et al., 2018).

This type of AI, also referred to as weak AI, is characterised by the fact that it can perform certain tasks—based on data, logic and algorithms—better than humans but is not able to outperform cognitive human tasks. Such weak AI only works in certain areas. Aspects of human behaviour, such as self-concept, self-control, self-awareness and self-motivation, cannot (yet) be mapped (Lu et al., 2018).

In this context, the criticisms of Royakkers et al. (2018) are no less justified: that ethical defensibility must be put to the test, but at least for the weak AI described, a clear distinction exists from human, value-oriented behaviour (Royakkers et al., 2018). The ethical aspect as well as legal issues should continue to be critically discussed and considered, as AI already adopts a variety of tasks in companies. The previous comments already illustrate a strong impact on work. Mobile, smart devices with a constant availability of information—both in terms of information gathering and information delivery—that enable interaction and collaboration with everyone in the business context and also provide data and information to an artificial intelligence to work with, clearly underlines the extent of the impact of technology (Kolbjørnsrud, Amico and Thomas, 2017).

Human Machine Interaction

The increasing use of AI - in both private and professional contexts - leads to an elevated level of human interaction with technologies. Although the degree of interaction with technologies is not equally extensive in all areas, there is an increase in so-called human-machine interaction (HMI) for all areas (Krupitzer et al., 2020).

HMI is understood as the "interaction and communication between human users and a machine, a dynamic technical system, via a human-machine interface" (Johannsen, 2009, p. 132). Modern interfaces include the technologies described previously, such as AR, VR, or speech recognition, which allow interaction with a digital technology. The research field of HMI is not new with a history of more than 60 years (Johannsen, 2009) and therefore not limited to the context of digital transformation. However, due to increasingly widespread interactions between people and machines, or digital technologies, HMI also must be considered in the context of this research study.

Bauer et al. (2016) provide a classification of interaction types that relates to Industry 4.0 applications in their elaboration. However, based on the described technological drivers and interfaces to humans (such as VR or AR), an adaptation of the classification in this context is reasonable (Krupitzer et al., 2020). The four types according to Bauer et al. (2016) are divided into coexistence, cooperation, collaboration, and substitution. "In the case of coexistence, humans and machines do not share a common workspace or a common goal at any point in time. Cooperation means that humans and machines work together to achieve a jointly defined goal. Humans and machines pursue different tasks that are independent of each other. Collaboration between humans and machines means achieving a common goal. Substitution can be defined as "the complete replacement of a human by a machine or robot" (Bauer et al., 2016, p. 335). Krupitzer et al. (2020) argue that the role of humans is increasingly changing "from complete control to partial control and supervision in interaction with machines" (Krupitzer et al., 2020, p. 5). This idea is also echoed by Kolbjørnsrud, Amico and Thomas, who postulate that "leaders (...) should (build) a diverse management cohort that balances organizational experience with social intelligence and digital acumen" (Kolbjørnsrud, Amico and Thomas, 2017, p. 6), as especially the

further adoption of AI (will) bring to the fore skills such as collaboration, creativity, and good judgment" (Kolbjørnsrud, Amico and Thomas, 2017, p. 6).

According to Park and Shintaku (2022), the increased use and increasingly intelligent technological support of machines, robots and digital technologies will lead to a further development of people's skills. Bajer (2017) also emphasises the importance of placing people and their human abilities at the centre and thus generating an opportunity from the digital transformation in connection with the interaction of technologies and people. This view is also followed in this study. Before the interaction of people with technologies can be considered in a more differentiated way, however, the question of the effects on the required human competencies arises in the context of the digital transformation, against the background of the understanding on which this is based. Accordingly, technologies are seen as part of the phenomenon that drives the digital transformation. HMI is therefore not at the core of this study and the impact of digital technologies on people will be considered further on.

2.3.2 The Impacts of Digital Technologies on Organisations

As the previous section demonstrates, the broad field of digital technologies is complex. The linking of large amounts of data, the connectivity of people with each other and with and from machines, automatisms through artificial intelligence and the interaction with voice assistants and other intelligent systems exert a significant influence on people. This influence is also making massive inroads into the world of work (Makridakis, 2017; Osmundsen, 2020; Kocak and Pawlowski, 2021). Hyperconnectivity creates new opportunities for business models and new forms of work but is also accompanied by changes in familiar work paradigms to which people must adapt quickly (Fredette et al., 2012; Makridakis, 2017). These are changing career paths, new demands on employees who not only need to be able to deal with these technologies, but also to properly understand the information and opportunities associated with them and translate them into successful action (Walwei, 2016; Makridakis, 2017; Osmundsen, 2020; Kocak and Pawlowski, 2021).

The nature of work is changing in many areas through increased mobility and flexibility, new communication channels and growing individual responsibility

(Hammermann and Stettes, 2016; Stettes, 2017; Osmundsen, 2020; Kocak and Pawlowski, 2021). The widespread use of media has led to these adaptations, but so has the pressure of increasing globalisation and the need for greater efficiency, most of which can only be achieved through automation and better collaboration on platforms (White, 2012). Further uncertainty can arise from insufficient information about the substitution of jobs by machines and technologies (Arntz et al., 2016b).

To understand the changes in the world of work and to gain insights into the respective consequences, the German Federal government commissioned a group of experts from business, science and technology in early 2010 (Absenger et al., 2016). Their focus was on the progressive merging of physical production with ICT. The thrust of the term Industry 4.0 led to other 4.0 successors, such as Work 4.0 and Services 4.0 (Absenger et al., 2016). One finding of the research was that digital technologies are bringing about a change in the previous organisation of work in all sectors and areas of the economy. (Absenger et al., 2016). However, in a 2015 study, Bonin et al. found that, unlike in an American study (Frey and Osborne, 2013, cited in Absenger et al., 2016), the extent of change in occupational profiles did not apply to Germany. Only 12% of occupations are affected by automation-related replacements (Bonin, Gregory and Zierahn, 2015). This view seems to be very short-sighted, as it only considers the pure substitutability of occupations by automation and by machines, not the changed demands on employees in the entire complex situation.

The findings in this section demonstrate that the starting point often times is digital technology, which leads to a culture change and a shift in activities (Kocak and Pawlowski, 2021). This goes hand in hand with a culture of knowledge-sharing and altered requirements for social competence in the context of collaboration (Hammermann and Stetters, 2016). Social competence, self-organisation and decentralised decision-making structures require employees to be more willing and able to take personal responsibility and critically reflect on themselves and their work (Absenger et al., 2016; Arnold et al., 2016; Hammermann and Stettes, 2016; Osmundsen, 2020; Kocak and Pawlowski, 2021).

2.4 Organisational Aspects

This section examines the relevant components from an organisational perspective and the main factors relevant to the RQ. The term ‘organisation’ offers a broad framework of components, which, however, are not all relevant for this thesis or cannot all be considered. As such, as described in Section 2.1, the selection was made on the basis of the influence on the phenomenon to be investigated, as shown in the relevance tree. The influencing factors were chosen from the perspective of digital technologies and the ongoing digital transformation. To provide the elaboration a structure, the introduced model clarifies that both exogenous and endogenous influences must be considered. In this section, the endogenous perspective is first outlined, with a special focus on the subject of GM and SHRM. The exogenous factors are then examined. The subsequent section considers the fact that the exogenous and endogenous influences described above impact the organisation of work in organisations. In the selection of the concepts considered, the reference to the digital transformation or the influence of digital technologies is decisive.

2.4.1 Endogenous View

2.4.1.1 Strategic Human Resource Management

Because Sub-section 2.2.3 has highlighted the complexity and importance of the phenomenon for an entire organisation, this makes a strategic approach necessary. Since the focus here is on the future key competencies and their advancement, SHRM becomes relevant. Defining this term against the background of the multitude of existing definitions is challenging (Armstrong and Brown, 2019). In examining the beginnings of this research discipline, some well-known definitions can be found. According to Fombrun, Tichy and Devanna (1984), SHRM is defined as ‘the critical leadership task is to align the formal structure and human resource systems to advance the strategic goals of the organisation’ (Fombrun, Tichy and Devanna, 1984, p. 37). Boxall describes the understanding of SHRM as ‘a management approach that encompasses those HR strategies designed to improve organisational performance and measures the impact of these strategies on organisational performance’ (Boxall, 2007, p. 1). Armstrong and Brown (2019) summarise that what the well-known definitions of SHRM have in common is that according to them, ‘The purpose of SHRM is to further

the goals of the organisation' (Armstrong and Brown, 2019, p. 6). This understanding underpins the 'intersection of strategic management and human resource management', according to Allen and Wright (2007, p. 8). This may lead to further confusion about where to draw the line between strategic management and human resource management and what this means in theory and practice regarding SHRM. To provide clarity for this thesis, the following understanding according to Armstrong and Brown (2019, p. 7) is used:

'SHRM is thus an overarching approach that provides guidance on how key human resource management issues can be strategically addressed to best support the achievement of organisational goals. However, SHRM only becomes real when it leads to actions and responses that can be considered strategic in this sense, either in the form of general or specific HR strategies or in the form of strategic behaviour on the part of HR professionals working with line managers.'

Within the research on SHRM, a number of models and various streams have emerged. Armstrong and Brown (2019) present a discussion of the streams and developments of SHRM over the last 30 years. An overview of the development of SHRM is also given, which is shown in *Figure 2-7*.

The origins of SHRM go back to Fombrun, Tichy and Devanna (1984) and Wright and McMahan (1992) with a more vertical understanding that places the alignment between strategy, human resource management systems and organisational structure at the core, but with the aim of contributing to strategy implementation (Berthel and Becker, 2017).

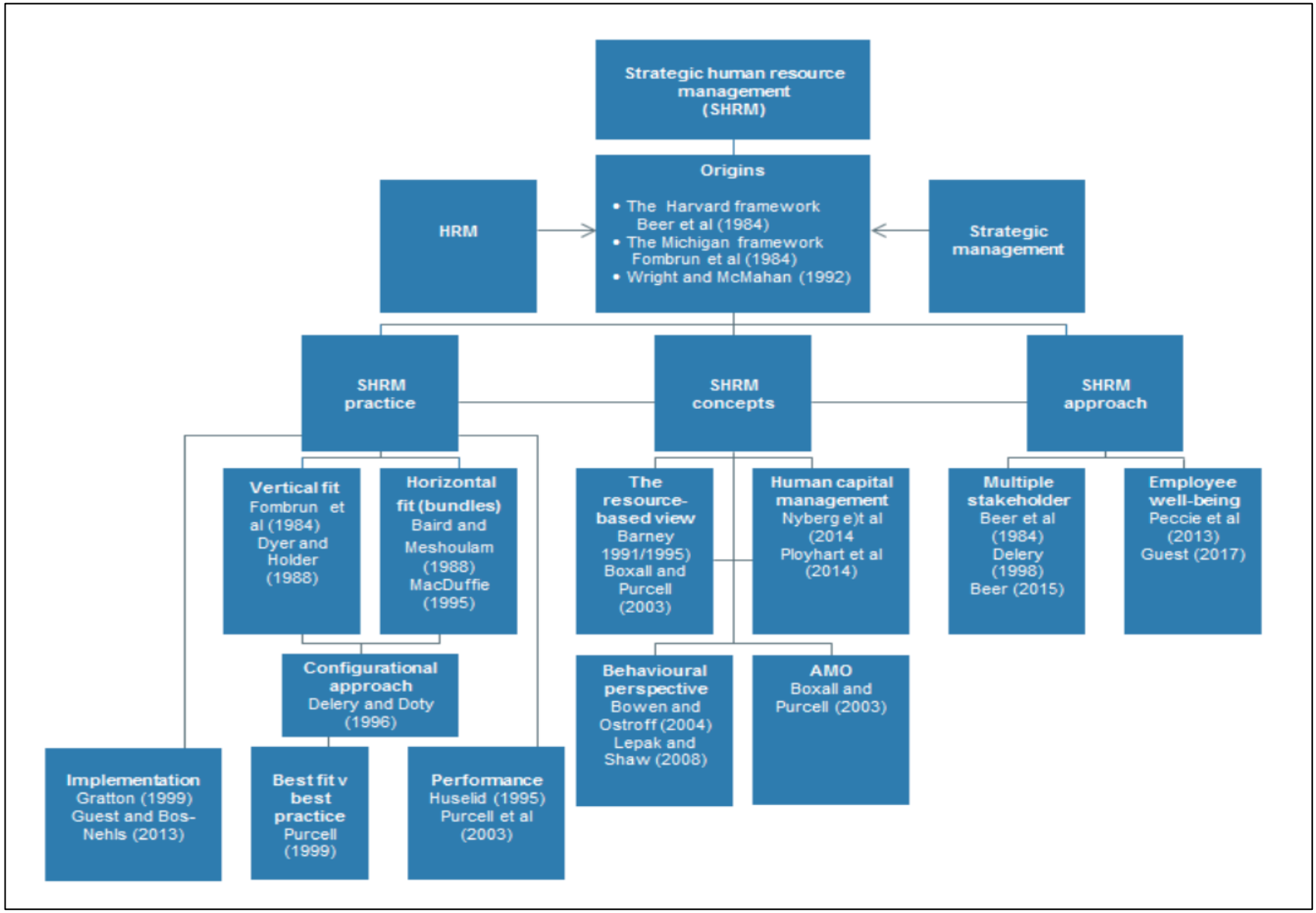

Figure 2-7: Model of strategic human resource management development (based on Armstrong and Brown 2019).

Similarly, from its beginnings, the Harvard Framework by Beer et al. (1984) already includes the stakeholders of a company. From these origins, several versions with different emphases have emerged. For the context of this thesis, the human behaviourist currents (Boxall and Purcell, 2003) are of particular interest, as well as the inclusion of external influences and different interest perspectives in the strategic orientation. Achieving any kind of performance is—as is often the case—not at the core of the considerations, since it is assumed that if the above-mentioned aspects are fulfilled, performance and thus success will also be achieved. Rather, following the view of Hamadamin and Atan (2019), performance in today's dynamic and competitive business world leads to competitive advantage primarily through employee knowledge, their commitment and thus the employees themselves. The evidence of the impact of SHRM was demonstrated in their study, which showed a 'linear and positive impact of strategic HRM on the sustainability of competitive advantage; strategic HRM was also found to positively influence human capital development and employee retention in institutions' (Hamadamin and Atan, 2019, p.2). This underlines the ability of SHRM to achieve more than merely improving performance. Particularly in the digitally driven world of work, whose dynamics and complexity will increase in the future, the potential of impact is at the same time linked to the fact that SHRM pursues a correspondingly differentiated conceptualisation. This means that aspects of work design and a stronger focus on the individual must also be considered (Collings et al., 2021).

A major criticism is that SHRM research is circular and lacks a broad stakeholder perspective in most models (Armstrong and Brown, 2019; Collings et al., 2021). Moreover, current research in the field of SHRM, with a particular focus on decentralised and virtual work, which is increasingly finding its way into organisations through digital transformation, is not to be found. ‘The question of how the organisation's culture and values influence the impact of work location on individual or unit performance remains an important’ RQ (Collings et al., 2021, p. 2). As such, SHRM plays an interesting and decisive role in the context of the present research problem, but no current findings from this field are available to date. In addition, an HRM strategy is not common in organisations of GM, as the following explains in detail (Welter et al., 2015; Eggers and Hollmann, 2018).

2.4.1.2 German Mittelstand

2.4.1.2.1 Characteristics

German Mittelstand is a unique construct worldwide (Welter et al., 2015; Bundesverband Mittelständische Wirtschaft (BVMW), 2020). It is considered of great importance, especially within Germany, according to descriptions such as the 'backbone and growth engine of the German economy' (Schäfer, 2004). Nevertheless, the definition of the term 'Mittelstand' is not clear; no uniform or precise understanding of the term exists (Wolter and Hauser, 2001; Kinne, 2009). In addition to quantitative factors, such as size, in combination with other business parameters, qualitative characteristics also define GM. A popular understanding of GM is provided by the Institute for Mittelstand Research in Bonn (IfM Bonn, 2020), which focuses primarily on the unity of ownership and management. Specifically, the following two criteria must be met:

- 'Up to two natural persons or their family members (directly or indirectly) hold at least 50% of the shares in a company, and
- these natural persons are part of the management'.

The criteria for the unity of ownership and management entail that large enterprises also belong to the definition of GM, provided they meet the above criteria. No upper limit exists with regard to the number of employees (IfM Bonn, 2020). The distinction between small- and medium-sized enterprises (SMEs) and the Mittelstand is also not based exclusively on quantitative criteria. Rather, it is the aforementioned qualitative characteristics that define the Mittelstand (Ulrich, 2011). As explained, the qualitative characteristics refer to the participation of family members in the management and ownership of the business. This also justifies a synonymous use of the terms 'Mittelstand', 'family business', 'owner-managed business' and 'family-run business', which are also used in this thesis (Becker, Staffel and Ulrich, 2008; Ulrich, 2011; BVMW, 2020; IfM Bonn, 2020).

To consider that the quantitative characteristics of a company are not the decisive criterion for belonging to GM but are simply used for an understanding, further

company forms are defined below. The term ‘enterprise form’ does not mean a strict classification of the legal forms of enterprises but refers to criteria of enterprise size and qualitative factors. These two aspects, quantitative and qualitative factors, are used to define the term ‘German Mittelstand’ and relate it to other forms of enterprise.

Starting with a quantitative demarcation of the German Mittelstand sector from other forms of enterprise, a first boundary can be drawn with sole proprietorships and micro-enterprises. According to §19 German Commercial Code (HGB), sole proprietorships must have the legal form of a ‘registered merchant (e.K.)’ and are subject to different liability, tax and accounting guidelines than corporations. This form of company is not considered further here, because such companies do not comprise their own legal personality.

According to EU Recommendation 2003/361, from 6 May 2003, micro-enterprises, the legal form of which are corporations, are defined as enterprises employing fewer than 10 persons and whose annual turnover or annual balance sheet does not exceed 2 million euros (Die Kommission Der Europäischen Gemeinschaft, 2003). This definition is mainly used for statistical and empirical surveys, as well as for access to financial resources and EU funding programmes. German health insurance companies, tax offices and the Federal Employment Agency, on the other hand, do not use the classification ‘micro-enterprise’ (Gruenderlexikon, 2020).

According to size criteria, micro-enterprises are followed by SMEs. According to this definition, small enterprises are companies with between 10 and 49 employees and whose annual turnover or annual balance sheet total does not exceed 10 million euros (Die Kommission Der Europäischen Gemeinschaft, 2003; IfM Bonn, 2020). In comparison, medium-sized enterprises have up to 249 employees and either an annual turnover of 50 million euros or an annual balance sheet total of no more than 43 million euros (Die Kommission Der Europäischen Gemeinschaft, 2003). The IfM Bonn classification, on the other hand, differs in the number of employees and sets the definition limit for medium-sized enterprises at up to 499 employees. The reason given for this difference from the European Commission is the special features of the German market resulting from the data collection. ‘The differences can be traced back to four main reasons:

- Differences in data sources and methods of data generation,
- Differences in the economic sectors covered,
- Differences in recognition characteristics,
- Differences in the definition of German Mittelstand " (IfM Bonn, 2020).

The European Commission's definition applies to the entire European Economic Area (Die Kommission Der Europäischen Gemeinschaften, 2003) and is thus used for legislation in the member states and for economic development measures, amongst other applications. The German Mittelstand definition of the IfM Bonn, on the other hand, is more relevant for a scientific consideration of Germany as a business location and for practical issues (HK Bremen, 2020).

Regardless of the exact thresholds for the number of employees, SMEs are usually equated with the Mittelstand because there is a large overlap, although this Mittelstand and SMEs are not the same (Kinne, 2009; Welter et al., 2015; BVMW, 2020; IfM Bonn, 2020); GM also includes companies that fall into the category of large enterprises according to the criteria of size, turnover and balance sheet total. Large enterprises are those with more than 250 employees that generate an annual turnover of more than 50 million euros (Die Kommission Der Europäischen Gemeinschaften, 2003). Similar to the differences in classification of the IfM Bonn regarding medium-sized enterprises, a company is only classified as a large enterprise from 500 employees (IfM Bonn, 2020). The Commercial Code differentiates other contexts as criteria for large companies, including the issue of securities or admission to trading on an organised market (Bundesministerium für Justiz (BfJ), 2022).

The qualitative demarcation criteria in particular make GM especially interesting as a subject of study. The unity of ownership and management, as a central qualitative characteristic for the Mittelstand, is linked to special conditions that are considered in the context of the topic of this thesis (Ulrich, 2011; IfM Bonn, 2020). One of these aspects is the personal influence of the owner on the enterprise. Since the owner is also the bearer of entrepreneurial risk, and the company is the basis of their own income and livelihood, the owner is attributed a deeper emotional attachment to the company

(Becker, Staffel and Ulrich, 2008; Welter et al., 2015; IfM Bonn, 2020). In addition, a specific value attitude is present, as well as good adaptability, innovative strength, sustainability and independence (Welter et al., 2015). Complementing this, Damken (2007) argues that the concept of GM has both 'an economic and a socio-psychological perspective' (Damken, 2007, p. 58). The latter in particular focuses on the individual 'entrepreneur', with their social responsibility, which is supported by the origin of the term 'Mittelstand' as the 'sociological position of a group in the middle of society' by Pleitner (cited in Ulrich, 2011, p. 20). The aspect of belonging to a society is reflected in the understanding of the Mittelstand in terms of regional responsibility (Roscher, 2015). With regard to sociological position, a causal relationship can be found with the workforce. Mittelstand companies employ a relatively limited number of employees, who are usually characterised by a high degree of loyalty to the company, a long retention period and regional roots (Gantzel, 1962; Pfohl, 1997; Berghoff, 2006). In this context, specific values and sustainability are also emphasised (Welter et al., 2015).

Adaptability and innovative strength can also be attributed to the ownership structure, particularly the lack of directives and the associated freedom to make decisions independently of third parties (Welter et al., 2015). The often-leaner organisational structure further simplifies decision-making and thus offers rapid responsiveness in the interplay between globally organised markets and regional interdependencies. However, these special opportunities are also accompanied by special risks, which are not only of a monetary nature but can also affect the reputation in the region, moral aspects, the relationship with customers and suppliers and the commitment of the workforce (Günterberg and Wolter, 2002; Becker, Staffel and Ulrich, 2008; Welter et al., 2015).

German Mittelstand is characterised above all by owner management and the desire to continue the business and pass it on to the next generation (whether as a family or in the form of a succession) in a better condition than when the owner took over (Berghoff, 2006; Roscher, 2015; Welter et al., 2015).

However, these characteristics should be viewed critically, as there are no generally accepted statistical criteria for defining GM and thus no basis for validation (Lies, 2018).

2.4.1.2.2 Leadership, Strategy, and Culture

As the previous section demonstrates, the point of unity of ownership and leadership is the characteristic feature of GM above all other aspects. Following from this, this section examines the characteristic aspects of leadership and strategy in GM in relation to this unity. For the remainder of this thesis, the understanding of leadership is first briefly outlined before the special features of GM are highlighted and strategy addressed in the next step.

According to the Gabler Business Dictionary (Lies, 2018), leadership is defined—not uniformly—as 'the people-, behaviour-, trait-, interaction- and/or motivation-oriented tasks of management'. Leadership and management are not considered the same thing; management is more characterised by planning, structures and the implementation of processes and has stronger analytical components (Lunenburg, 2011; Lies, 2018). Leadership, on the other hand, encompasses qualities such as charisma, personality, beliefs, values, ethical behaviour and sympathy, as well as the ability to motivate people and spur them to behave in a certain way through rhetorical persuasion (Sharma and Jain, 2013; Lies, 2018).

Based on this understanding of leadership, especially the aspects of personality and conviction, the senior owners mentioned in the previous section can be identified. If an entrepreneurial individual advances their own entrepreneurial interests and simultaneously bears the risk, then, according to the above understanding, this behaviour is more likely to be found in the area of leadership than management (Kinne, 2009). Interesting in Mittelstand companies is that, according to the given understanding, the owner is often also responsible for management tasks and enforces them equally (Welter et al., 2015; Bijedić et al., 2018). An exact separation of leadership and management is hence not always obvious in individual cases, partly due to the size of the company (Lunenburg, 2011; Welter et al., 2015).

In terms of making strategic decisions, GM again reflects the unity of ownership and management, as well as a firm value system based on trust. Especially in family businesses, family members are often consulted before decisions are made (Welter et al., 2015). If it is not a family business, trusted persons who are (emotionally) close to

the business or management are also involved in the consultation and decision-making process. The reason for this is that egoism—as with external advisors—can be ruled out, as can a strong asymmetry of information, which would encourage a misinterpretation of impacts and risks (Welter et al., 2015). A strong influence of the owner or the owning family on strategic management exists in GM. However, it would be a misjudgement if this were to call into question the strategic orientation of GM compared to non-GM enterprises. Strategic positioning in the market, considering competition and innovation, is guided by the need to ensure sustainable and long-term success and takes equal account of responsibility towards employees, customers and business partners. Furthermore, this also shows that instinctive decisions do not prevail in the Mittelstand. According to Gernell, there is no typical leadership and decision-making behaviour for GM (Becker, Staffel, and Ulrich, 2008; Welter et al., 2015).

German Mittelstand is characterised by sustainable entrepreneurial action, which is largely led by owners. The personalities of the owners or the ownership family hence play a major role in the culture of the company (Sharma and Jain, 2013; Roscher, 2015). Sustainability and a responsible approach to risk in an independent company are factors that are not only characteristic of GM companies and shape their culture but to which their unbroken success is also largely attributed (Gantzel, 1962; Welter et al.2015). Conversely, however, no evidence exists that a non-GM company is less sustainable or responsible. These companies are also equally concerned with sustainability and corporate responsibility.

The relationship between employees and management, are typical characteristics of the Mittelstand which are also partly mentioned. A close relationship between employees and a greater willingness to invest in the workforce is often found in Mittelstand companies. The model of vocational training has a high value, and it is not uncommon even today in GM companies to have employment relationships that begin with training and only end when the employee retires (Welter et al., 2015). Whether these characteristics are due to the classification ‘Mittelstand’ or are anchored in the respective culture of an individual company—whether from GM or not—cannot be proven but should remain questionable in the context of a critical examination. The fact that an increase in the knowledge of the workforce is driven in GM can be deduced

from statistical data. If one considers that, according to the definition of the IfM Bonn, 99.5% of all companies in Germany belong to the Mittelstand sector, and thus 58% of all employees subject to social insurance contributions work there, it is not surprising that, in contrast to large companies, a high willingness to invest in the workforce exists. With such proportions, it must always be borne in mind that a differentiation according to 'Mittelstand', as it is understood in this work, is only insufficiently possible, since the defining qualitative characteristics of GM (management, ownership, economic independence) can only be inadequately read from the official statistics. (BVMW, 2020; IfM Bonn, 2020).

The arguments put forth, especially with regard to passing on the business to the next generation of the family or the cultural imprint of the owners or ownership family, seem logical. At the same time, however, these assessments assume (e.g., with regard to the cultural imprint of the management of non-medium-sized companies) that the same value cannot be attached to the management of these companies. This fact, as well as the lack of differences in the above-mentioned point of strategic orientation, calls the claimed differences into question and demands valid evidence. In this context, it must be critically questioned to what extent the self-image of GM and the desire to belong (evoked by statements, such as 'backbone and engine of the German economy') attempt to underline this differentiation and protect it as a kind of seal of quality.

Nevertheless, the self-image, as well as the quantitative and qualitative characteristics, of the Mittelstand in Germany, as explained above, spur research by entire Mittelstand associations and federations and thus cannot be dismissed out of hand. In the further course of this thesis, the term 'Mittelstand' is used based on the understanding of the term from the previous explanations and thus follows the definition of the IfM Bonn, as this definition is used for scientific and market-oriented studies of the German Mittelstand, and a validation of the term 'Mittelstand' is not the subject of this thesis (IfM Bonn, 2020).

Due to the ambiguous classification and the self-image that has been highlighted, it is challenging to use previous findings from research work as a comparison and thus as a basis for this work. Numerous publications undoubtedly exists, both from theoretical research activities in the field and from programmes funded

by the Federal government that have set the research of digital transformation as their core objective. The ‘Mittelstand Digital’ programme by the BMWi, which has been pursuing the mission of supporting SMEs with questions and projects related to digital transformation through a growing network and numerous regional competence centres since 2012, should be highlighted (BMWia, 2021)[1].

In the course of the research for this thesis, publications that primarily present content on competencies have been considered. It is noticeable that, on the one hand, a strong focus on the area of production exists, and on the other hand, the understanding of competencies falls short. This occurs because in German, there is no differentiation between ‘competences’ and ‘competencies’ (see Sub-section 2.5.2 for thorough definitions of these terms). In addition, competencies are primarily closely related to technology (i.e., its operation and the handling of information produced by these technologies; Hartmann and Berndt, 2019). No in-depth analyses are presented that focus on the human component or illuminate its many facets with regard to competencies, considering the entire interrelationship of effects. In the author’s opinion, the results presented do not go far enough. The human being is the decisive success factor and carrier of a large part of organisational knowledge and must therefore be scientifically elaborated with much more clarity. In addition, behavioural patterns of human action amongst the actors are a crucial factor for successful cooperation (Bajer, 2017; Kocak and Pawlowski, 2021).

2.4.2 Exogenous View

An indispensable characteristic for all types of organisations to survive and respond to internal, as well as external, influences is the ability to change. Influencing factors that come from within, such as a new leadership or management structure, a newly proclaimed vision, a change in the organisation’s sponsorship or the introduction of new technologies, are covered in the previous section focusing on GM. This subsection places the external influences that act on an organisation at the core of the consideration.

[1] An up-to-date list of the competence centres, including their respective focus areas, can be found on the BMWi website: https://www.mittelstand-digital.de/MD/Navigation/Karte/SiteGlobals/Forms/Formulare/karte-formular.html?cl2Categories_Status=laufendeprojekte

External influences include, for example, the increasing globalisation of markets and the associated rise in competitive pressure, regulatory requirements on the part of legislators and changes in the demand behaviour of customers or business partners. Technologies can also exert an external influence on production or other areas of value creation, if their use is established to produce more quickly or cost-efficiently or to offer optimised services to the market (Abdi et al., 2011; Senior, Swailes and Carnall, 2020). Senior, Swailes and Carnall (2020) summarise the different directions of external influences under the acronym PEST: political, economic, social and technological factors. It is obvious that influences can also come from several of the described directions simultaneously, which illustrates how complex the field of influences is. A decisive success factor for dealing with influences that make change necessary is therefore the resulting reaction that an organisation or the responsible persons derive from them. Actions and decisions in this regard are taken by owners and managers. At the same time, this means that exogenous influences are always evaluated and addressed from an endogenous perspective. Experience, market knowledge and the attitudes of decision-makers towards change are thus critical. Equally important is the prevailing culture in the company, which must be open to change (Senior, Swailes and Carnall, 2020). Another crucial factor is the willingness and ability of employees to adapt to new conditions (Zucchi and Edwards, 1999). In today's world, change must also occur at a high speed to keep up with the dynamics of markets and technological development. This prevailing factor makes it necessary for organisations to not only make one-off changes but also be able to continuously adapt strategies, processes and procedures (Daft, 2001).

The rapidly increasing influence of digital technologies on global and regional markets and thus also on each individual organisation reinforces the need for organisations to change successfully—sometimes radically, but above all quickly and continuously (Osmundsen, 2020; Kocak and Pawlowski, 2021). This is associated with numerous measures and opportunities in the design of value creation throughout the entire chain. At the same time, companies are subject to numerous regulations by the legislature, which limit actions and changes accordingly. Especially with the focus on the work of people in organisations, labour laws take effect that are binding and must therefore be considered. Against the backdrop of increasing mechanisation, there are

growing opportunities to make work more flexible in most areas. Remote access to systems and cloud applications enables mobile working and thus decouples work from a fixed location. This increase in mobility also shifts the times when work can be done. The place of work and working hours are regulated by the Occupational Health and Safety Act (ArbSchG), under §5. However, when work moves out of the organisation's sphere of influence in terms of time and space, new requirements arise to continue to ensure the protection of employees under these new conditions. This is because, in addition to setting up the workplace, equipping it with the necessary work equipment and defining work processes, the law also requires the employer to ensure that employees have the appropriate qualifications. Another component of the legislation relates to the mental health of employees, which must be assessed by the employer to prevent mental illness (§5 ArbSchG). The protection of employees from mental and physical harm is not only regulated by law; ethical and moral demands on employers also exist and, in the case of a deliberate violation, would lead to damage to their reputations, which in turn can also potentially be reflected in reduced economic success. This aspect is not at the core of the investigations within the scope of this thesis. At the same time, all aspects considered are based on ethical and moral action, and violations are explicitly excluded and condemned in the strongest possible terms.

2.4.3 The Organisation of the Organisation

2.4.3.1 Business Process Reengineering

In the previous sections, the exogenous and endogenous aspects of the phenomenon of 'digital transformation' were at the core of the analysis. In this chapter, the question of how organisations deal with change—especially change driven by technological developments—is explored. To begin with, the paradigm of business process reengineering (BPR) is presented, which is based on the modernisation of production and process optimisation enabled by digital technologies. BPR can enable organisations to respond appropriately to the influences and associated need for change just described and to maintain competitiveness (Abdi et al., 2011; Sikdar and Payyazhi, 2014; Hashem, 2019). Particularly in the current context—the influence and use of digital technologies in the context of digitalisation—a consideration of BPR seems obvious, although measures in organisations that change business processes through or

due to digital technologies do not necessarily simultaneously pursue an approach that fully corresponds to the understanding of BPR.

BPR has been a much-discussed approach to the rapid and radical implementation of change in organisations since the 1990s (Zucchi and Edwards, 1999). As often as BPR is the subject of research and also practice, there are also different understandings or diverging terminologies. Synonyms for BPR include, for example, 'business process redesign', 'business process innovation' and 'business process management', which are also subsumed under BPR in the following (Klein, 1994; O'Neill and Sohal, 1999; Zucchi and Edwards, 1999). The above synonyms make a clear understanding of the term difficult. Furthermore, there is also no universally accepted definition of BPR in the literature, although it is widely agreed that the term was coined by Hammer (1990) and Davenport and Short (1990) in the early 1990s, when BPR became a popular management phenomenon (Zucchi and Edwards, 1999). According to Davenport and Short (1990), BPR refers to the analysis and design of workflows and processes within and between organisations to achieve radical improvements in performance.

Attaran (2004) defines the goal of BPR as a 'radical improvement approach (to) rapidly and substantially improve organisational performance by redesigning the core business process' (Attaran, 2004, p. 585). The extent in terms of depth and scope of change can vary widely from company to company (Hall, Rosenthal and Wade, 1993; Davenport and Stoddard, 1994; Teng, Grove and Fiedler, 1996). Al-Mashari, Irani and Zairi (2001) criticise that the focus on performance improvement is too narrow and represents a Taylorist approach. Sikdar and Payyazhi (2014) point to a holistic perspective of business process redesign that also requires organisational realignment with all affected roles and actors. Technology has the potential to support radical and effective change, but without integration into a holistic approach to change, it ignores aspects of an organisation's culture, strategy and structure (Davenport, 1993; Wastell, White and Kawalek, 1994; O'Neill and Sohal, 1999; Attaran, 2004; Sikdar and Payyazhi, 2014; Bhaskar, 2018).

Similarly, O'Neill and Sohal (1999) argue that BPR comprises radical process improvement. Their critical review of the existing literature and various definitions

conflates tools and methods from the state of the art with the conclusion that it is not the tools that are critical to success but the strategic approach driven by management. For this reason, it is not surprising that the final conclusion emphasises the view of BPR as change management and the human factors of organisational change as core elements of the strategic and cross-functional approach (Davenport, 1993; O'Neill and Sohal, 1999).

A strong focus on processes alone and a neglect of the full spectrum of this organisational change, especially people, has been cited as a primary reason for the failure of BPR projects (Klein, 1994; Al-Mashari and Zairi, 1999; Zucchi and Edwards, 1999; Al-Mashari, Irani and Zairi, 2001; Attaran, 2004; Sikdar and Payyazhi, 2014).

The link between newly defined processes and a change in organisational functions, jobs and responsibilities is an obvious but complex observation that has been considered in various literature (Davenport and Short, 1990; Al-Mashari and Zairi, 1999). Although job design is mentioned as one part of the design process, a broader consideration of the design of new work involving motivational and contextual aspects remains open (Teng, Grove and Fiedler, 1996; Attaran, 2004; Abdi et al., 2011; Sikdar and Payyazhi, 2014).

The BPR approaches described and the components highlighted are means to radically and quickly adapt the use of new technologies in the form of changed business processes. However, the holistic understanding of the phenomenon of digital transformation remains unconsidered. At the same time, the question remains open as to how exactly the affected managers and employees must be empowered to be able to act in a radical change process adapted to the new situation (Cameron and Green, 2020).

BPR is an approach to change in companies that can noticeably improve value creation through the possibilities of new technologies. It is characterised by a rapid and radical change of the entire organisational process. The goal is to maintain competitiveness and ensure the successful continuation of the organisation. Digital technologies are both a driver for change and an essential tool to bring about improvements. However, the prevailing culture of the organisation, management and employees is fundamental to successful change and particularly critical to success in a dynamic environment. Although it is recognised below that both management and

employees are crucial factors for change (brought about by BPR) in organisations, BPR is not sufficient for elaborating the question underlying this paper. Rather, it is assumed here that new requirement profiles and new understandings of the activities are necessary for the aforementioned actors. Added to this is the consideration of the personalities of the people who, in the course of the upheaval, must be empowered to be able and willing to change (Cameron and Green, 2020). As Hammer and Champy (1993) argue, the redesign of business processes must be translated into the design of workplaces, revised organisational structures and management systems (Hammer and Champy, 1993). Building on this, the following section considers work and workplace design as an essential element of changing conditions in organisations and answers the question of whether workplace design is a component of BPR (Abdi et al., 2011; Sikdar and Pyyazhi, 2014) or whether BPR—like other approaches (e.g., lean manufacturing, total quality management or Six-Sigma)—is seen as an aspect of workplace design (Morgeson and Campion, 2003, p. 423) and is not crucial for gaining knowledge in this context.

2.4.3.2 Work Design

Theoretical Overview

Influences that affect an organisation, as is the case with digital technologies, lead to change. In the previous section, the BPR outlined and critiqued a possible approach to adapting to the ongoing technology-driven upheaval. The weaknesses identified there, which relate to the work design gap within the BPR, are theoretically closely linked to the issue of workplace design in general, making an addressing of work design appropriate for this study. Following this idea, the next section provides an overview of job design and concludes with an assessment of this approach to the underlying question. Starting with the question of what job design encompasses, a brief overview of the development of this complex field of research is then given to address current and relevant aspects of the field.

The term ‘job design’ is usually used synonymously with ‘work design’. This terminology is also used for the present work. In very simplified terms, work design essentially concerns the question of ‘content, structure and organisation of work tasks

and activities' in organisations (Van den Broeck and Parker, 2017, p.1). The focus has changed over the decades from the aspects of efficiency and productivity to the question of motivation, work characteristics and the aspect of employee well-being. Behaviour and learning are also considered. These findings are not only relevant from the perspective of work and organisational psychology, but significant implications also exist for operational practice when it comes to the question of appropriate workplace design—for the organisation and its results, but at least as much for the individual and their work experiences and work outcomes (Morgeson, Garza and Campion, 2013; Van den Broeck and Parker, 2017).

Especially against the background of work results and their efficiency, the origins of workplace design can be traced back in the literature to the beginning of the last century. The concept of scientific management systematically documented the design of workplaces with a focus on the goal of making work as efficient as possible, according to management's ideas. To achieve this, clear divisions of work into simple steps and measurements were used for control (Campion and Thayer, 1988; Morgeson, Garza and Campion, 2013; Van den Broeck and Parker, 2017). Human aspects were not considered in this approach, which on the one hand led to a decline in morale of people working in such systems and on the other opened up an extensive scientific discourse that built on this to consider other factors in workplace design (Morgeson, Garza and Campion, 2013; Van den Broeck and Parker, 2017).

First results could be observed in the context of social approaches. Positive effects of involving employees in the course of the 'Hawthorne studies', which led Mayo et al. (1924) to the realisation that—in contrast to Taylorism—employees are to be regarded as part of a social structure. This formed the basis for the human relations approaches, their further development in the socio-technical systems approaches through the research of the Tavistock Institute. The meaningfulness of work and a high degree of autonomy in the organisation of work were given measurable positive evidence. In the current context, it makes sense to consider this, as digital technology has a major impact on the changing world of work, amongst other things in terms of autonomy and meaningfulness. Similarly, a distinction must be made with BPR; technology also exerts a major impact on the concept of work design. Furthermore, it is

interesting for this paper to see to what extent the approach is reflected in current discussions due to increasing digitalisation (Van den Broeck and Parker, 2017).

Socio-technical approaches

Socio-technical systems research assumes that two systems exist: the technical and the social. People interact with each other and interact with the technical system, and this interaction affects the organisation itself, the people and the technology. Optimal interactions can only be achieved if both systems are appropriately aligned (Morgeson, Garza and Campion, 2013; Bendel and Latniak, 2020). According to Vansina and Taillieu (1994), the difference with the re-engineering approach can be explained by the goals that the approaches pursue: re-engineering focuses on processes, with the aim of achieving marketability through the increased value of the service provided to the customer. In contrast, the perspective of sociotechnical approaches is internal and focuses on the work process in terms of creating meaning and satisfaction amongst employees and thus achieving optimal work outcomes (Vansina and Taillieu, 1994; Morgeson, Garza and Campion, 2013). Due to varying country-specific characteristics in research on socio-technical systems, different emphases and understandings prevail under the same term. In the German context, the central concept is the work task upon which technical, organisational and qualitative elements act and which is thus used as the basis for assessing work quality (Bendel and Latniak, 2020). In the Anglo-Saxon understanding, the focus is more on autonomy and the creation of meaning, as well as the group level (Morgeson, Garza and Campion, 2013).

A further differentiation when considering socio-technical theories is worthwhile with regard to the primary object of design. In particular, earlier work has focused on the field of industry, while current work increasingly considers aspects of digitalisation as a technological component (Winby and Mohrman, 2018). In the context of increasing digitisation, the socio-technical systems approach is being explored in an adapted, digital variant, on the grounds that social systems in organisations are thereby not adapted to the same extent as technological systems evolve through digital opportunities (Winby and Mohrman, 2018). Winby and Mohrmann (2018) aptly demonstrate the complexity that arises from new, digital influences and also transcend the boundaries of a purely interorganisational view. However, the approach is too focused on the health

sector, which makes an adaptation generally difficult for any kind of organisations. The authors themselves acknowledge that individual adaptation to other use cases is highly dependent on the respective factors and individual actors (Winby and Mohrman, 2018).

Socio-technical systems theory—both in its origins and in current work—has focused primarily on the work task and the associated fulfilment within a work group (Van den Broeck and Parker, 2017). However, in the context of this work, the personal factors of employees for a changed work environment are considered a crucial point to answer the question of exactly which competencies are needed for this new environment.

Further Approaches to Job Design

The origins of the question of individual needs in the context of work design can be found in motivation theory, which first traces back to Herzberg (Van den Broeck and Parker, 2017). In Herzberg's two-factor theory—also called motivator–hygiene theory—motivation is supported by recognition, responsibility, personal growth, achievement and promotion for work done, while hygiene factors are those that are externally influenced, such as salary, working conditions and company policies. According to Herzberg (1968), only those factors that also target motivation have a positive influence on it, not changes in hygiene factors. Although the theory has been much criticised and empirically challenged, it is the cornerstone of today's work design models and was the first theory to link motivational potential to work tasks (Morgeson, Garza and Campion, 2013; Van den Broeck and Parker, 2017). This theory, as well as Oldham and Hackman's job characteristics approach, are key models still considered in job design today in terms of job enrichment and job enlargement (Morgeson, Garza and Campion, 2013; Van den Broeck and Parker, 2017). Oldham and Hackman (2010) follow Herzberg's view that motivation is a crucial factor in job content and particularly emphasise the importance of individual differences in skills, knowledge and abilities, as well as satisfaction in the overall context of the job. The model has been criticised for only considering motivational aspects and not factors such as stress or high workload and control (Morgeson, Garza and Campion, 2013; Van den Broeck and Parker, 2017). Karasek (1979) counters this criticism with his job–demand–control model, in which harmful and beneficial aspects of work design are related to each other in a model that

essentially focuses on long-term effects on employees, especially health effects. The consideration of well-being is extended by Warr's (1987) vitamin model, which also includes environmental aspects (vitamins) within and outside the work context. This illustrates the complexity of forces affecting development. Environmental aspects and individual characteristics are not transferable and therefore always individual to each personality type (Van den Broeck and Parker, 2017). The job demand resource (JD-R) model, which is known mainly in Europe, has a similar focus on employee health—especially with regard to burnout and overload—and models individual factors as personal resources in relation to job demands (Demerouti et al., 2001; Bakker, Demerouti and Sanz-Vergel, 2014; Van den Broeck and Parker, 2017).

The models presented here were—and are—the starting point for numerous other considerations, models and approaches in the context of work design research. Requirements are one aspect that many deal with (hindering and challenging). Much more extensive, for example, are works that consider both work characteristics and work context or outcomes and live up to the claim of relating all aspects (biological, ergonomic, motivational and mechatronic) that have often been focused on individually to date (Campion and Thayer, 1985, Morgeson and Humphrey, 2006; Morgeson, Garza and Campion, 2013; Van den Broeck and Parker, 2017). Another interesting and far more complex approach is presented by Parker (2014), who postulates goal achievement through work design in terms of increasing learning outcomes and developing cognitive and moral skills. In summary, the various models and approaches focus on different outcomes of workplace design: much well-being, less cognition and learning, and behaviour in various understandings. Asking about the factors that influence the impact of work is useful for workplace design. The challenge here, however, is that the design and influencing factors of the future for a digitally transformed world of work are not yet known in organisations in the German Mittelstand sector. For this reason, the gaps identified in the literature (Oldham and Fried, 2016; Morgeson, Garza and Campion, 2013; Van den Broeck and Parker, 2016) are valid but do not yet reach the core of the present research.

The presented models from both recent times and the history of work design have components that can be assumed to be of great interest for a consideration of work

of the future. However, these components must then be placed in a new context. This investigation is not the aim of the present study. Nevertheless, parts of it are useful to answer it with regard to a changing world of work through the expanding use of digital technologies. Similarly, the findings so far serve to identify relevant facets in the data collection to answer RQ1.

2.5 The Human Part

2.5.1 Human-related Aspects

In the determinants presented so far that influence the phenomenon of digital transformation in German Mittelstand, aspects of the acting human being have been addressed in different forms. It has also become apparent that these key components have not been sufficiently presented in the previous approaches. The aim of this chapter is thus to close this gap for the present literature review in the research context. This begins with a consideration of human characteristics that influence the fulfilment of the work task and make the implementation of measures possible in the first place. In contrast to the rational view of human beings, it is assumed that human action is conducted through personal characteristics that are anchored in the person. An action that is only conducted through previously created framework conditions (cause and effect) is not viewed holistically and can therefore only partially represent this complex context as an explanation for human behaviour. Instead, reasons lying within the individual influence an action and an attitude towards something. The author believes that massive changes in the reality of work will arise for people in connection with digital transformation—as previously explained in detail (Section 2.3). Ongoing changes evoke reactions in people that must be considered to shape the future in a meaningful way. These reactions can be fear or joy, curiosity or rejection. Even if these individual reactions are not the focus of consideration, the fact that they exist and influence human action must be recognised, which is why this aspect is included in the question of future competencies in this context (Meißner, 2012; Vakola, 2014). Heckhausen and Heckhausen and Heckhausen (2018, p. 5) argue for the holistic nature of the influences from the other perspective—that a pure consideration of the human component is not sufficient to explain situations and decisions—but thus support the holistic approach of this work.

Personality, Motive and Motivation

Personality has an impact upon attitudes to change—as it occurs in the context of digital transformation. Thus personality is an important component for change in general, but especially for understanding the role of the individual in this context (Meißner, 2012). One of the most common models for explaining and understanding human personality is the five-factor model of personality, which, based on Tupes and Christal (1961) and Norman (1963), underwent a generally established modelling by Goldberg (1990) and Digman (1990) (Diller, Asen and Späth, 2020, p. 3). Following Diller, Asen and Späth (2020, p. 12), the five dimensions are characterised by the following associated traits (Digman, 1990, p. 423; Barrick and Mount, 1991, p. 5; Diller, Asen and Späth, 2020, p. 12):

- Extraversion
    - Outgoing, active, sociable
- Openness to experience
    - Curious, creative, imaginative
    - The only personality dimension reliably related to intelligence (Judge and Bono, 2000)
- Agreeableness
    - Trustworthiness, generosity and friendliness
- Conscientiousness
    - Achievement and reliability
    - Correlates best with job performance (Barrick and Mount, 1991)
- Neuroticism
    - Also called emotional adjustment

- Anxiety, self-pity and tension (McCrae and John, 1992)
- Relationship between neuroticism, life satisfaction and general well-being (McCrae and Costa Jr., 1991).

Guided by the conviction that one's personality traits have a decisive influence on the willingness to change and the ability to adapt, Diller, Asen and Späth (2020) present a study that examines the connection of personality traits according to the Big Five model for the profession of tax consultants in Munich. The quantitative study focuses primarily on tax advisors themselves as leaders and states that personality plays a role in the '…preparation of employees for new challenges' (Diller, Asen and Späth, 2020, p. 2). The view underlying this work that digital transformation concerns not only technologies, business models and processes, but also the ability of individuals to adapt to this situation, is equally supported (Diller, Asen and Späth, 2020, p. 2). However, the findings of the study are limited to the correlation of the five factors of personality to digitalisation from the perspective of tax consultants in Munich. To the best of the author's knowledge, further studies investigating correlations in the area of personality and digitalisation or digital transformation have not been conducted to date. Similarly, the challenges of the underlying understanding of the phenomenon of 'digital transformation' are different in all research, so comparability is not possible at this point. Another aspect that is not adequately considered in the study by Diller, Asen and Späth (2020) is the inclusion of respective (work) situation. The present study addresses this gap by considering endogenous and exogenous perspectives for an organisation simultaneously.

The inclusion of situational factors has already been explained throughout the work. In addition, these factors, in connection with personal characteristics, are the explanatory framework for a person's motivation to pursue a certain goal (Heckhausen and Heckhausen, 2008, p. 7, Berthel and Becker, 2017, p. 58). According to Heckhausen and Heckhausen (2008, p. 7), 'The motivation of a person to pursue a certain goal… depends on situational incentives, personal preferences and their interaction… The resulting motivational tendency is composed of the various incentives of the activity, the result of the action and both internal, self-assessment related, and external consequences, weighted according to the personal motivational profile'. From

the perspective of a person and their motivation, this once again underlines the interdependence of individual and situation. This interdependence has not yet been explored in research on digital transformation.

2.5.2 Competencies

The previous sections have shown that the high dynamics on the market and in companies, caused by digital technologies, place new demands on all market participants. Employees in particular play an important role in maintaining competitiveness (Amorim et al. 2019, p. 8556). It is thus crucial to hire employees with the right skills in the right places in the company (Ibrahim and Hasnan, 2014, p. 142). The fact that in the current situation, it is not yet possible to design clear requirements for future job profiles, and that it is particularly interesting for companies to have knowledge about skills and competencies to be developed for existing employees, was highlighted in the previous sections. As such, this section of the thesis focuses primarily on the competencies of the workforce. These competencies comprise the core of the study. To create a basis for this, the term ‘competencies’ is discussed in the following with regard to prevailing understandings in the organisational context. In addition, existing research is analysed against the background of the phenomenon of digital transformation. As a further aspect, the regionalism of the study in Germany is included for an understanding of the term.

This research occurs in German Mittelstand and therefore brings with it the challenge that there is no word in German for the English ‘competencies’ and that this is also translated as ‘competences’. This circumstance must be considered more carefully in the discussion. For the understanding and delimitation of the definition of competencies on which this work is based, an overview of German understandings is given here (Delamare Le Deist and Winterton, 2005, p. 30). In Germany, competences describe several—also not consistently related or defined—skills and aptitudes of people in a vocational context, as well as components of vocational education and training and contents of Vocational Education and Training (VET) curricula. Thus, occupational competence is the VET theory itself on which it is based. Included are key qualifications, which include person-related competencies such as independent action, problem-solving, flexibility, ethical and moral maturity. The competencies for action

(professional competence, technical competence, personal competence and social competence, methodological competence) are an elementary component of VET in Germany (Delamare Le Deist and Winterton, 2005, p. 37f.). Here, the focus is clearly on vocational qualification and the assessment of this vocational education in the form of a final examination in the dual German system. In the present context, no current research can be found that has used this understanding of competencies as a basis for gaining insights into future key competencies for digital transformation in GM.

The use of 'competence' and 'competency' is inconsistent, even in the English language usage in science. Woodruffe (1991) draws a distinction and describes competences as a functional ability to do something, whereas competency is defined more broadly and, in addition to professional and methodological competencies, also includes characteristics of the person who possesses a competence (Woodruffe, 1991 cited in Delamare Le Deist and Winterton, 2005, p. 27). There are also different understandings and field contexts of competency in the competency literature (Hoffmann, 1999).

The question of important competencies can be found in many disciplines, such as psychology, education, pharmacy, nursing, politics, management theory and personnel management. It is hence not surprising that there are accordingly numerous understandings from these fields (Hoffmann 1999, p. 275). In addition to the subject area, there are further aspects of the areas of application of competencies, such as for learning, recruiting, selection, change, performance, remuneration, training, or development of employees or people, bring with them a varying purpose of application and thus different definitions of the term (Özçelik and Ferman, 2006; Robinson et al., 2007). The consideration of competencies gains further complexity when country-specific currents are considered. According to Delamare, Le Deist and Winterton (2005), US approaches are traditionally behaviourist, while those from the UK are characterised by a functional approach. Research from Germany, France and Austria follows a more holistic and multi-dimensional approach, which can be explained in the above-mentioned diversity of the term 'competence' in German (Delamare Le Deist and Winterton, 2005, pp. 33).

The research interest of this thesis focuses on organisational context. In this area, research on competencies was initially shaped by McClelland (1973), Boyatzis (1982) and Spencer and Spencer (1993) (Hoffmann, 1999, p. 275; Özçelik and Ferman, 2006, p. 73). McClelland's (1973) approach was based on the finding that behavioural characteristics were more useful in assessing above-average and average job performance than the aptitude and intelligence tests used at the time. Boyatzis (1982) focused his research primarily on the competencies of responsible and high performers and their identification and development. Boyatzis (1982) defines competencies as the basic characteristics of a person that lead to superior performance in a particular occupation. According to Spencer and Spencer (1993, p. 9), these fundamental characteristics are 'the combination of an individual's underlying attributes, skills, traits, knowledge, and motives that are causally related to superior performance in an occupation' (Spencer and Spencer, 1993, p. 9). Austin (2019) states that 'competency is not about a test score; it is about an understanding of one's strengths, limitations, and relationship to an occupation and the ability to articulate this clearly and persuasively'. Similarly, competencies is understood by Nordhaug (1993, cited in Murawski and Bick, 2017, p. 723) in a work-organisational context as a combination of skills, knowledge and abilities. The deeper reference to the personal imprint innate to an individual (in the sense of personality and motivation) is also at the heart of the understanding of competencies by Gorbacheva et al. (2016) and Müller et al. (2014). According to them, competencies are 'innate to an individual (e.g., the ability to think logically). Knowledge means a theoretical understanding of a concept, while competencies are the practical application of this knowledge' (cited in Murawski and Bick, 2017, p. 723).

Underlying Understanding for the Study

When examining the literature, it becomes clear that the term 'competencies' is used in different ways and that, as a result, numerous understandings exist. In summary, competencies are understood as behaviours or actions (behavioural orientation) or as underlying abilities and characteristics or the results of actions are placed in the focus of consideration (task orientation; Robinson et al., 2007, p. 65-66). Hoffmann (1999, p. 276) divides the positions into three main understandings:

- Observable performance that is measurable and visible through output
- The standard or quality of a person's performance with regard to the outcome:
    - Standards can be of different nature, and
    - One possible application is the management of change. New standards in a new work setting, which are then used for evaluation and thus guide the change process (here, too, the output counts); and
- The underlying characteristics of a person:
    - Focus here is on the input of people (basis for the definition of a qualification programme to define required knowledge and characteristics)

In the first two approaches, the output is in the foreground and can therefore also be used as a basis for assessing work performance. In the third approach, which refers to the underlying characteristics of the person, the output is not exactly defined or not (yet) known, which is why the core of this position is the required input of a person to define competencies. For the present work, this reflects the existing situation. The output cannot be defined at present due to several future uncertainties. A future picture of the effects of the digital transformation must be drawn to provide support in defining the necessary competencies for the working world in GM that is shaped in this way, which is what this study intends to do.

Beyond the positions just outlined, competencies can be further divided into different categories—areas of impact. Based on Carrol and McCrackin (1998), there are three categories. The first includes core competencies that are important for all employees to support and fulfil the strategic orientation of the company; these are therefore not only required of individuals or roles but of all members of the organisation. Although these can be institutionalised, all individual employees must hold them. The second category is that of leadership and management competence, and the third category is that which requires job-specific skills (Özçelik and Ferman, 2006). For this paper, the understanding of key competencies is adapted to the effect that

competencies are of interest that will be of great importance to all employees in a company in the future, regardless of job role or hierarchical position, equal to the core competencies outlined by Carrol and McCrackin (1998). However, this understanding does not refer to organisational competencies but to the level of individual persons. Another current overview of different categories of competency is provided by Shet, Patil and Chandawarkar (2017), who classify the understandings of individual authors. However, this does not form clusters or put the individual categories in relation to each other (Shet, Patil and Chandawarkar, 2017, p. 6). A clearer distinction is offered by Boyatzis (2008), who distinguishes between threshold competencies and three clusters of competencies as differentiators of excellence (Boyatzis, 2008, p. 7). According to this, threshold competencies are clustered into the following:

1.) Expertise and experience;

2.) Knowledge (i.e., declarative, procedural, functional and metacognitive); and

3.) A range of basic cognitive skills, such as memory and deductive reasoning

Boyatzis (2008, p.7) differentiates between average and outstanding performance through the three clusters:

1.) Cognitive skills, such as systems thinking and pattern recognition;

2.) Emotional intelligence skills, including self-awareness and self-management skills, such as emotional self-awareness and emotional self-control; and

3.) Social intelligence skills, including social awareness and relationship management skills, such as empathy and teamwork.

Boyatzis (2008) thus underlines the view that ‘competencies are a behavioural approach to emotional, social and cognitive intelligence’ (Boyatzis, 2008, p. 7). Using Boyatzis’ (2008) clusters, the various competencies from German can be assigned and supplemented so that this cluster can be used as a basis for data evaluation; as such, Boyatzis’ (2008) understanding of competencies is adapted for this work for the explicit understanding of the key competencies which are of great importance for all employees in a company.

The previous explanations have focused primarily on the purpose and various definitions of competencies. To make a statement about the quality or necessity of competencies, however, in addition to a clear purpose and a consistently adapted definition, it is also imperative to consider the respective context in which they are applied (Özçelik and Ferman, 2006, p. 74). Based on the respective organisational environment, market and sector-specific characteristics, political and social framework conditions, competencies must be considered. On the one hand, this consideration is related to measurability and meaningfulness with regard to the fulfilment of the task (performance). On the other hand, the aforementioned factors of the environment are also necessary when considering competencies, if a statement is to be made about the correct input of a person (behaviour-oriented perspective). The inclusion of the environment and a structured recording, assessment or research of competencies for the respective setting then leads to a corresponding competencies model or framework that is used in organisations for the respective purpose. The use of competency profiles and models has been increasingly used in HR in companies since the 1990s and is referred to in this case as competency(-based) management (Robinson et al., 2007).

2.5.3 Research on Competency Identification in Context of Digital Transformation

Especially in the context of this research, the framework conditions to be considered have already been clearly defined with GM and digital transformation. The importance of this contextual reference between digital transformation and competencies is also postulated by Hoel and Holtkamp (2012). To do justice to the contextual reference in this research work, it is thus necessary to refer to existing scientific findings that consider both competencies and digital transformation (in the broadest sense). A direct reference to the German Mittelstand sector is not yet possible due to the aforementioned linguistic disparities, and the discussed peculiarities of GM (see subsection 2.4.1.2).

The state of research to date shows initial findings on competencies for the digital transformation (digitalisation). Increasingly—although not exclusively—research on ‘digital competence(s)’ is delivering results. Murwaski and Bick (2017, p. 722) validate existing findings and, based on an intensive literature review, find that a few studies exist on digital competencies with a focus on ‘Big Data’, ‘virtual team

leadership' as well as 'HR functions' and 'IT departments' (Murwaski and Bick, 2017; Karaevli et al., 2020). The underlying understanding of digital competence is aligned with Vieru (2015, p. 6725) and Ala-Mutka (2011) and clearly distinguishes itself from the ability to use technology (software and/or hardware); it instead includes 'instrumental knowledge and the skills to use tools and media; advanced skills and knowledge to communicate and collaborate, manage information, learn and problem solve, and participate meaningfully; and attitudes to use skills strategically in intercultural, critical, creative, responsible and autonomous ways' (Murawski and Bick, 2017, p. 726). Thus, '… digital literacy (is) a multidisciplinary topic that cannot be assigned to only one research field. Digital competence definitions lack scientific depth' (Murawski and Bick, 2017, p. 726). Murawski and Bick's (2017) call for 'research (to) address the topic of digital workforce competencies' (Murawski and Bick, 2017, p. 726) on the one hand considers the understanding of competencies in the digital context and on the other aims to focus on the workforce without limiting it to the already mentioned areas of 'Big Data' and 'virtual team leadership', as well as 'HR functions' and 'IT departments' (Murawski and Bick, 2017, p. 726). The research agenda in the field of digital competencies presented by Murwaski and Bick (2017) explicitly calls for the investigation of future job profiles and required digital competencies. The development of a 'comprehensive definition of the term (…) also appears necessary (in this context). In addition, there are various ways to examine digital competencies of the workforce in relation to human resource management' (Murawski and Bick, 2017, p. 729.).

A recent research paper in the field of competencies for digital transformation by Osmundsen (2020) comes closer to the understanding of competencies as it also appears in this paper, yet competencies are considered more at the organisational level. In her study of the Norwegian energy sector, she clarifies the terminological ambiguity between skills and competencies and defines 'digital transformation (DT) competencies as a firm's bundle of its collective competencies (skills, knowledge, expertise, experience, and other employee attributes) that are essential for a DT and includes the firm's ability to combine these attributes in responding to and managing the DT' (Osmundsen, 2020, p. 4328). Her findings underline that it is a complex challenge to strengthen and develop the necessary competencies within an organisation, even if they are constantly changing. Following Butschan et al. (2018), she describes some

competencies as primarily cognitive, ‘including willingness to learn, openness to change, problem-solving skills and expertise’ (Osmundsen, 2020, p. 4328). Due to the limitation to the Norwegian energy sector, one approach she mentions for valuable further research is exploration in other areas and industries.

An identification of future competencies for digital transformation was conducted by Fonseca and Picoto (2020) by means of a Delphi study with two rounds. The competencies from the European Digital Competence Framework for Citizens, known as DigComp 2.0, were used for the assessment (Vuorikari et al., 2016; Fonseca and Picoto, 2020). The competencies listed there have a strong focus on the use of digital technologies and disregard general capabilities, which, for this research, falls short and fails to reflect the present understanding and scope of the change.

In 2021, Kocak and Pawlowski identified digital competencies and the digital mindset through a systematic literature review and then prioritised them in focus groups for leaders and employees, respectively. The participants of the focus groups came primarily from the university environment, with a few from consulting in the field of digital transformation. As a demarcation, the authors themselves clarify that there was no focus on a specific sector. Moreover, there is no contextual understanding of digital transformation, only the results from the literature analysis as a basis for the competencies and mindset (Kocak and Pawlowski, 2021).

Previous studies have either focused heavily on technologies or contained definitional imprecision or regional limitations. While the research gap of this paper is supported by current research, it is not possible to use the previous results for the underlying research problem.

An examination of competency frameworks that focus on future skills is provided, for example, by Salas-Pilco (2013). She gives a chronological overview of 21st century frameworks and their development. It becomes clear that while these frameworks regard the impact of digital technologies as the basis for changing requirements, the focus is on general societal change and education and not specifically on the impact on companies and their employees. This implies popular studies by UNESCO, OECD (programme: Definition and Selection of Competencies: Theoretical

and conceptual foundations [DeSeCo]), North Central Regional Educational Laboratory (NCREL), the European Parliament, and the assessment and teaching of 21st century skills (ATCS), which are excluded from the scope of this work due to their focus on educational institutions.

Further research into existing research on future (key) competencies in the context of digital transformation can also be found under another term: 'Industry 4.0', as delimited above. The term possesses too strong a focus on manufacturing and the automation of processes, and this does not correspond to the holistic understanding of the phenomenon of digital transformation. Nevertheless, it makes sense to look at results that use this terminology, as it often has intersections and facets with digital transformation. A recent contribution by Prifti et al. (2017), for example, develops a competency model for 'Industrie 4.0' employees. However, the focus of the study is only on specific—technology-related—fields of activity (information systems, computer science and engineering). As such, this research offers too limited a representation of the activities under consideration to be relevant for answering the RQs presented here, but it does support the finding that little research is available on this new topic (Prifti et al., 2017, p. 51). Other contributions, such as those by Amorim et al. (2019), offer a broader understanding of digital transformation but place technological competencies very much at the core of the framework developed and leave open a precise definition of transversal competencies. Moreover, this study is regionally concentrated on Portugal and focuses specifically on the industrial sector.

In summary, existing research in the area of future competencies is increasing due to growing interest. However, the challenges in addressing this area are manifold. On the one hand, this is due to the numerous and strongly varying conceptual understandings both in the fields of digital transformation and competencies. This alone gives rise to many possible combinations of objects of study. In addition, there is the focus on the educational area, which is often investigated in the area of future competencies, and furthermore, national results are often not comparable with each other, especially not if the object of study is specifically located in one sector or industry (Delamare Le Deist and Winterton, 2005; Özçelik and Ferman, 2006; Robinson et al., 2007.) Accordingly, the preceding discussion of existing research once again

highlights the identified gap, which this paper aims to close.

Robinson et al. (2007) address the question of an efficient approach to predicting future competence requirements. Here, the focus is explicitly placed on the method of the survey, not on the results of the demonstrated case. In doing so, they counter the criticism of existing competence approaches that are related to a past or maximum current state, which is not expedient for the consideration of future needs in times of strong change (Robinson et al., 2007, p. 67). This article is particularly interesting for a later methodological discussion, as it discusses a multi-stage procedure, with a combination of established survey methods (critical incidents technique, repertory grid technique, business scenarios, Delphi technique). However, no substantive findings for the context of future key competencies for digital transformation in GM can be derived from this.

The aim of this work is to explore the digital transformation in German Mittelstand, to understand the phenomenon as well as its influences within organisations, and based on this, to identify which future key competencies will be needed in the future and how they can be advanced. Accordingly, a comparison with existing findings on competencies is not possible for various reasons. In some studies, the results are aimed at the required competencies for existing job profiles (Butschan et al., 2018; Osmundsen, 2020). However, it cannot be assumed whether and to what extent these will be relevant in the future. In addition, key competencies should be researched (i.e., competencies that are important for all employees regardless of the exact job profile). Furthermore, existing research often lacks a strict orientation towards the future. In research that focuses on the influence of digital transformation, either the scope is limited to Industry 4.0 and technology, or the underlying understanding of the phenomenon of digital transformation does not correspond to this work (Prifti et al., 2017; Butschan et al., 2018). In addition, the focus on GM is missing in these cases. Finally—and this challenge is independent of the area of digital transformation—the understanding and purpose of competencies alone is so diverse that comparability is difficult without the other parameters. Thus, it can be stated that a gap exists in current research that examines future key competencies for digital transformation in GM. The present study aims to close this gap.

2.6 Findings from the Literature Review

2.6.1 Identified Gaps in Current Research

The aim of this literature review has been to examine the relevant areas that influence this research in accordance with the question to be addressed and to critically question them to gain the knowledge sought after here. The underlying procedure has been outlined in Section 2.1. Even during the examination of the underlying terminology in the field of digitalisation and digital transformation, it became clear that no uniform definition exists (Hess et al., 2019; i-SCOOP, n. d.b; Verhoef et al., 2021). This fact was considered for the further course of the literature review by creating a separate understanding for this thesis. Based on this, current research in the field of digital transformation has been presented as a basis for a conceptualisation. Previously published models used for the conceptual framework show the interaction of several areas affected by digital transformation. However, the models considered lack both the complexity and dynamics of the phenomenon of digital transformation—as understood here. For this reason, a separate model has been developed as a conceptual framework for this work. This model, presented in *Figure 2-8*, lays the foundation for further considerations.

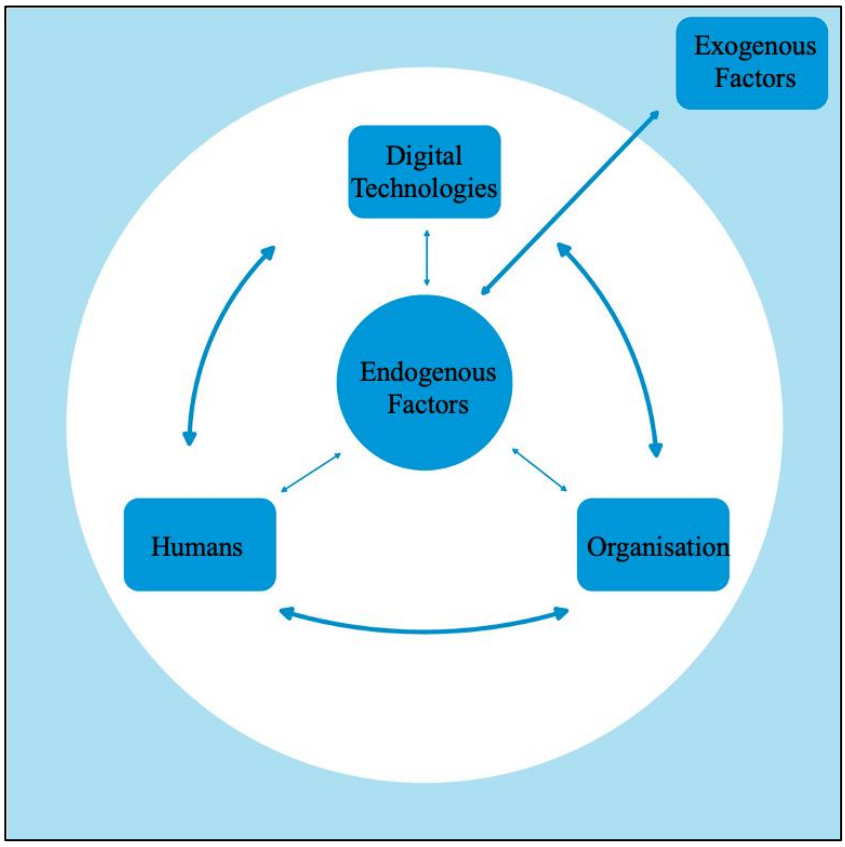

Figure 2-8: Conceptual framework of the influencing determinants of digital transformation in German Mittelstand.

Although some important factors and findings can be found in the current literature within the individual impact fields, the holistic approach is not fulfilled. The gaps identified in the concepts considered are summarised below and graphically illustrated in the model. The particular impact area considered is marked by a green frame to give the reader more orientation within the illustration. If an area of impact is considered, it is coloured blue. If the area is not considered in the theories under consideration, it is marked in red. The same colouring is also found in the arrows that symbolise the consideration of an interaction. For example, an area may not be explicitly considered in depth, but a general effect may be mentioned or a connection derived. In this case, the arrow is coloured blue.

This consideration is based on the conceptual framework, developed and introduced in sub-section 2.2.3. Furthermore, the significance and relevance for the present research context is assessed by whether and to what extent the respective contribution belongs to the relevant intersection of the areas of digital technologies,

organisation and humans (see *Figure 2.9*).

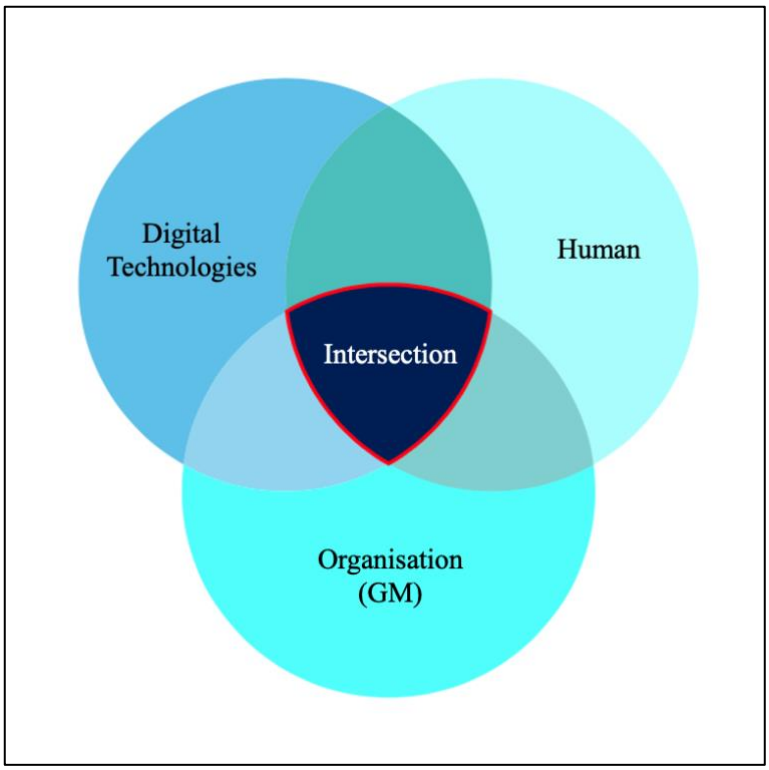

Figure 2-9: Intersection of the relevant areas of influence.

Area of Impact 'Digital Technologies'

The influence of digital technologies on work can be seen in a constant and immense increase in data and its processing, as well as permanent access and interaction via platforms (Makridakis, 2017). In this context, it is obvious that the nature of work is influenced by increased information density and new forms of interaction. As described, these types of interaction can be divided into different classes—coexistence, cooperation, collaboration and substitution (Bauer et al., 2018, p. 335). Another logical consequence that follows from this is that new digital technologies bring about changes in the fulfilment of work tasks (Fredette et al., 2012; Walwei, 2016; Makridakis, 2017; Osmundsen, 2020; Kocak and Pawlowski, 2021). Equally obvious is the consequence that with these changes, the culture and social competencies of the individual must also be adapted to these work realities (Absenger et al., 2016; Arnold et al., 2016; Hammermann and Stettes, 2016; Kocak and Pawlowski, 2021). However, what exactly influences German Mittelstand corporations, considering the organisation of work, as well as the exact demands on employees, has not yet been fully clarified at this point.

Similarly, the interactions across organisational boundaries that are presented are addressed but not sufficiently explained in terms of the resulting endogenous factors. This area—endogenous factors—is also not considered in depth. It becomes clear that although the influence of digital technologies is evident in all areas, the interactions—especially bilaterally—cannot be fully explained, as *Figure 2-10* illustrates.

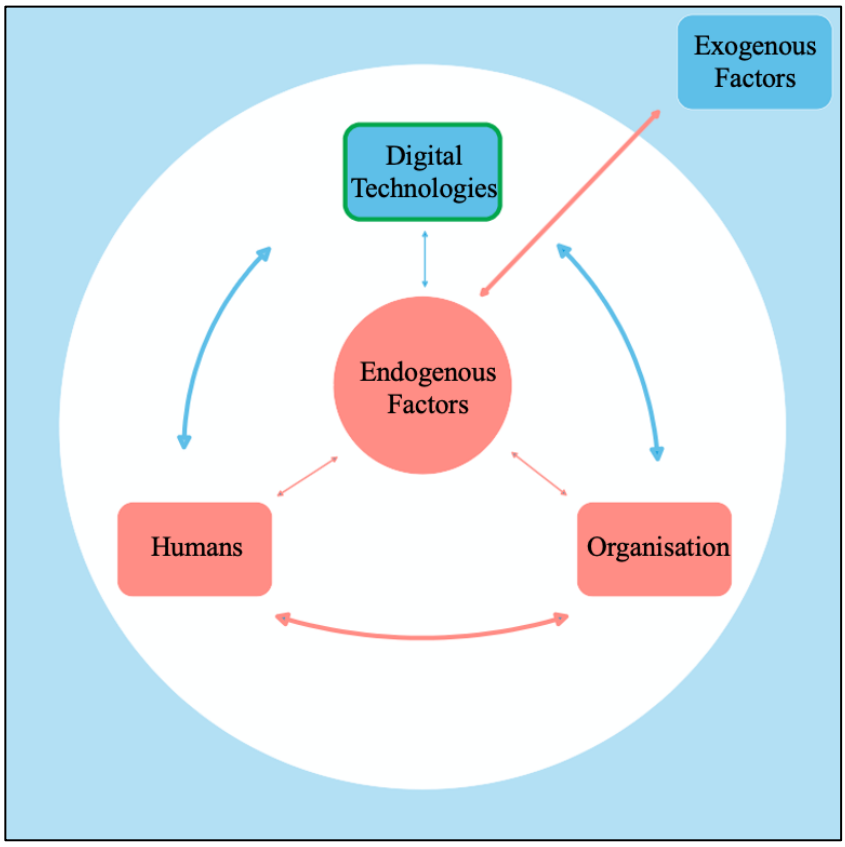

Figure 2-10: Area of impact 'Digital technologies'.

Area of Impact 'Organisation—Exogenous Factors'

The scope of exogenous factors is diverse. A division according to Senior, Swailes and Carnall (2020) into political, economic, social and technological factors also illustrates the importance of the effect of external changes on organisations in the present context (Senior, Swailes and Carnall, 2020). Political factors here also include the aforementioned labour legislation, which has a binding regulatory influence on people, work design and work equipment in organisations (§5 ArbSchG). Economic influences such as competition in the respective market and globalisation affect the field of action of the digital transformation in organisations. This also includes events such as

the COVID-19 pandemic, which—amongst numerous other far-reaching effects—brings about economic changes for every organisation. However, the pandemic also influences social aspects, which are also exogenous factors that lead to the need for change in organisations. In addition, social changes can also be caused by the behaviour of society and the associated socialisation of people. In relation to the use of digital technologies and progressive digital transformation, how people interact in private, in families and in all other areas of society is also changing. These, in turn, carry the influences of change into organisations and the social fabric that exists there. The last of the four factors of change according to Senior, Swailes and Carnall (2020)—technological factors—is a central component of this work. In the previous section, the influences of technology in companies have been outlined. From this perspective of an exogenous factor, this can additionally be subsumed in the area of business interaction between organisations and between organisations and state bodies. The classification of the four factors is not clear-cut, so it is not surprising that technological influence—just like the other influencing factors—does not occur alone, but usually in combination with the previously mentioned factors (Senior, Swailes and Carnall, 2020). For the present context, this means that the exogenous factors mentioned directly influence the digital technologies used and are also present on the endogenous factors. The endogenous factors in particular, such as strategic orientation and the concrete implementation of external requirements by the organisation's management, are interpretations of the exogenous influences from the internal perspective. Furthermore, the influence on the organisation and the people in it is relatively indirect and cannot be fully explained on the basis of this perspective (see *Figure 2-11*).

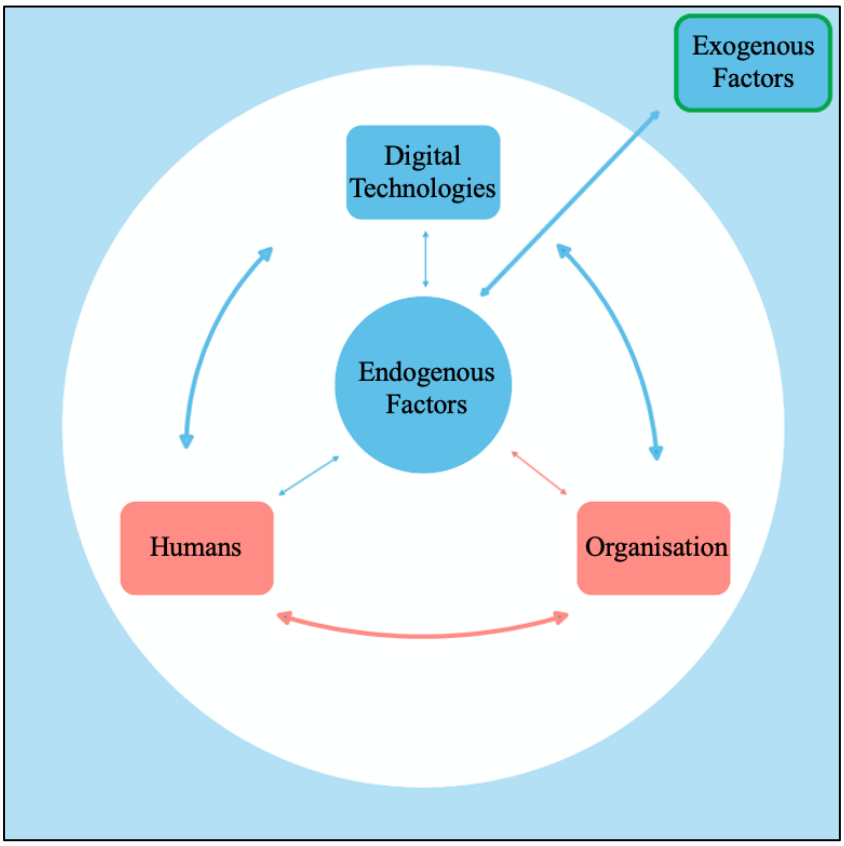

Figure 2-11: Area of impact 'Organisation—Exogenous factors'.

Area of Impact 'Organisation—Endogenous Factors'

From the perspective of the endogenous factors, the relationship with the exogenous factors is to be evaluated bilaterally, just as in the reverse case. It is possible to influence markets, interest groups and social, technological and political changes. In Sub-section 2.4.1.2, this is underlined for GM by the great importance attached to this construct. The characterisation as the 'backbone and growth engine of the German economy' (Schäfer, 2004) shows—irrespective of precise quantitative criteria for belonging to the Mittelstand—that associated enterprises occupy a crucial place in the economy. The examination of an essential qualitative characteristic of the Mittelstand—the unity of ownership and leadership and the associated strategy and leadership behaviour—presents interesting and promising approaches for the context of this work. Soft factors that emphasise attachment (including emotional) to the organisation are of particular interest (Sharma and Jain, 2013; Roscher, 2015). However, the consequences for people and the use of digital technologies on the whole are insufficient in this study

so far. This inadequacy also applies to the discussed SHRM aspects from Sub-section 2.4.1.1, which, according to the current state of research, do not present any recommendations for action for design in the context of digital transformation (Collings et al., 2021).

The inward-looking assessment for the present study context shows that the influences in the areas of ‘digital technologies’, ‘humans’ and ‘organisation’ can be explained, as well as, to some degree, the effects of these areas on each other. However, a concrete reference to the area of digital technologies is still lacking. In this context, much research focuses on the organisation of the organisation, especially in the context of production (Abdi et al., 2011; Senior, Swailes and Carnall, 2020).. This also explains why the field of digital technologies is not considered sufficient for the understanding and research area on which this thesis is based. The same applies to people and a concrete elaboration of the human aspects in the field of digital transformation. The graphical representation of the findings from the endogenous factors is shown accordingly in *Figure 2-12*.

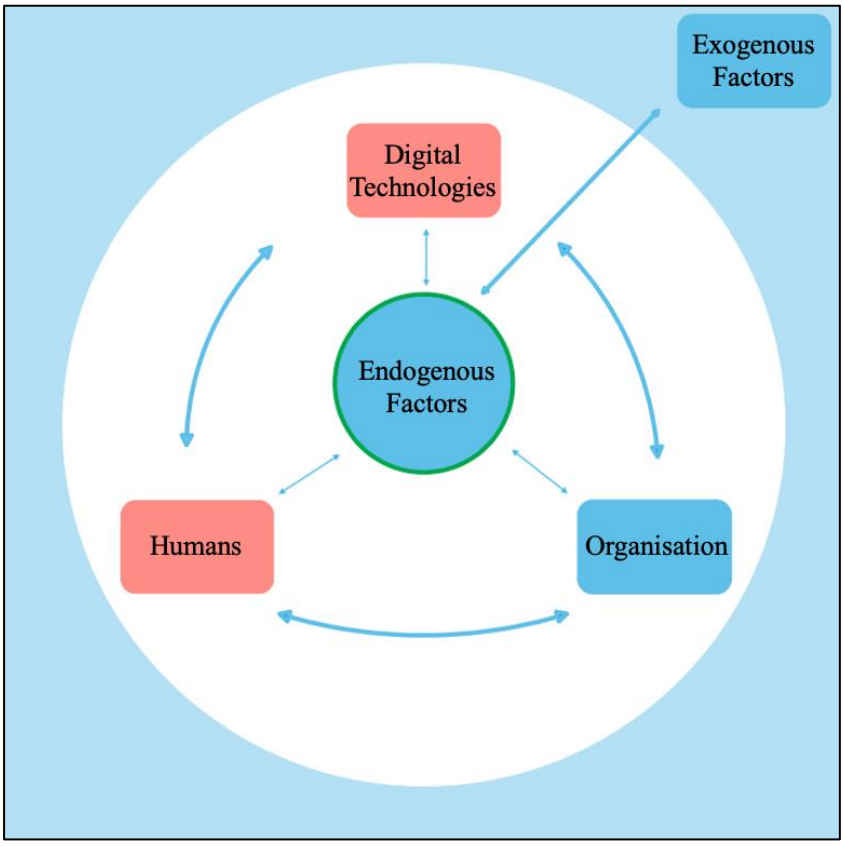

Figure 2-12: Area of impact ‘Organisation—Endogenous factors’.

Area of Impact ‘Organisation—Organisation of the Organisation—Business Process Reengineering’

The discussion on BPR has made explicit that the approach is pursued with the aim of achieving a competitive advantage through the use of new or modern technologies, which is subsequently achieved through a radical and rapid change of all organisational processes. The close dependence on technology and focus on reorganisation promise a meaningful approach to technology-driven modernisation. The effects of external influences considered in this approach in particular offers an advantage to the dynamics of modern markets. A disadvantage of the BPR, however, is its superficial treatment of the human component. This applies both to changing demands on employees and specific recommendations for action and a critical examination of the design of business processes and questions about leadership for a change process according to BPR (Hammer and Champy, 1993, p. 203; Cameron and Green, 2020, p. 49). The focus consequently remains on the process level and often concentrates more on the area of production in research. The holistic nature of change in the context of digital transformation—as conceptualised in this thesis—is not considered and thus cannot suffice as an overall basis for answering the RQ (see *Figure 2-13*).

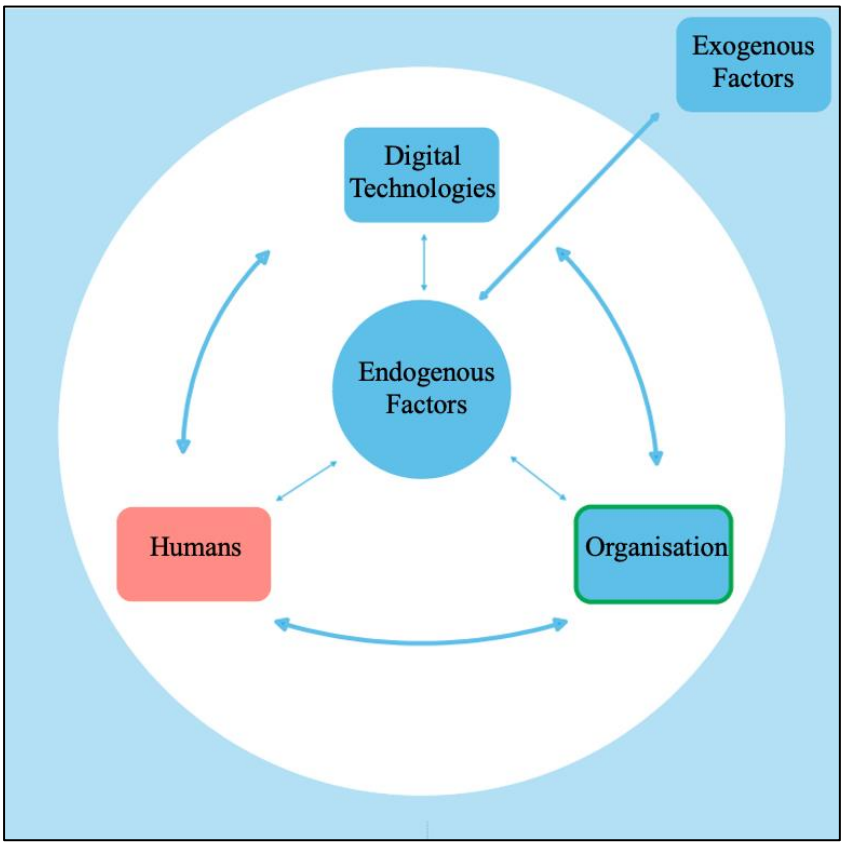

Figure 2-13: Area of impact 'Organisation–Organisation of the organisation—Business process re-engineering'.

Area of Impact 'Organisation—Organisation of the Organisation—Job Design'

The debate on job design has produced numerous facets. Some approaches—especially from the 1950s—are based on a view of human beings as a production factor and are therefore not applicable to this study. In the course of time, the view of human beings has changed, and the approaches have increasingly focused on performance and, later, well-being. Motivational aspects can also be found. However, no explicit reference is made to the phenomenon of digital transformation. A clear gap in the research landscape has been identified in the area of job design by Oldham and Fried (2016, p. 30) 'Job design and new work arrangements' and Oldham and Fried (2016, p. 31) 'The effects of jobs on jobholders'. Although the understanding of the full complexity of the phenomenon is not explicated, the need for research is related to modern work environments and thus guides the direction of this thesis. The aim of this

work is not to develop an adequate job design but to use relevant approaches, such as motivational aspects and satisfaction, as well as the fact that employees must possess the appropriate skills to perform. The organisational environment and individual person also play a role in the approaches presented. Only the reference to digital technologies and the influences of the markets, as well as legislation, are left out of the existing findings, as *Figure 2-14* illustrates. This is also to the detriment of the dynamics that must be considered in the present construct for an overall result.

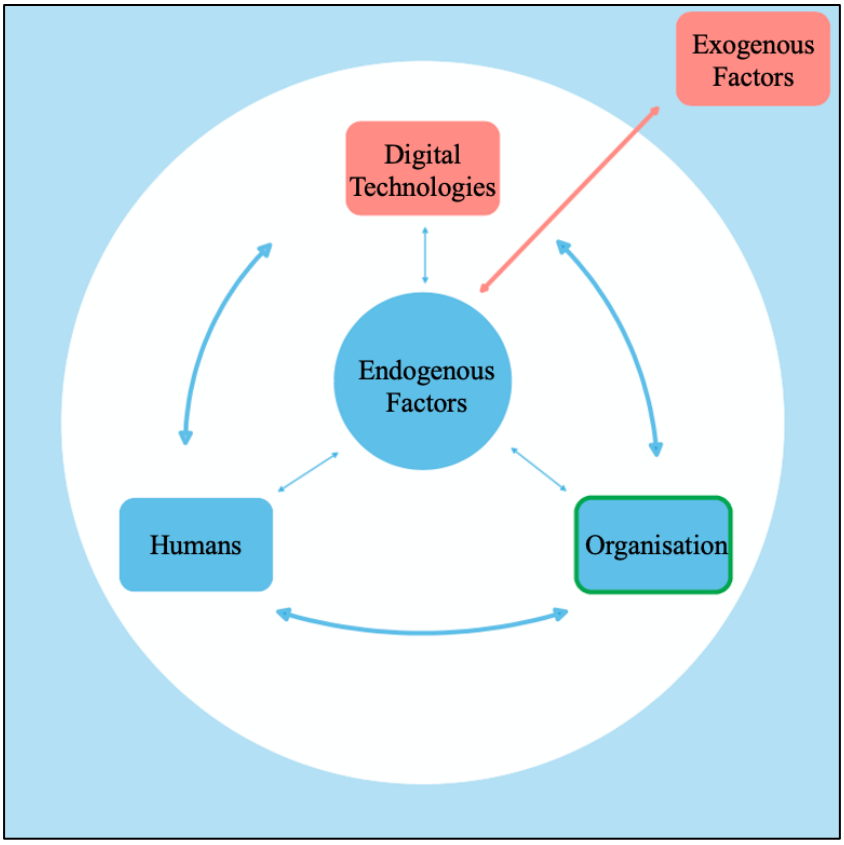

Figure 2-14: Area of impact 'Organisation–Organisation of the organisation—Job design'.

Area of Impact 'Organisation—Organisation of the Organisation—Socio-technical Approaches'

Socio-technical approaches play a prominent role in the literature review on job design. The focus is explicitly on the coordination between people and technologies, as well as the associated work organisation. However, the approaches miss the effects and influences on the endogenous perspective in detail. The framework of strategy and

prevailing culture, as well as the specific findings on leadership, are largely ignored. Likewise, effects from the organisational environment are not considered. While the human component is highlighted in the focus, precise evidence of the skills required to align the socio-system with the technology is not identified. Critical also is the fact that the technological component is often more quickly developed, and therefore the human component cannot adapt to new conditions at the same speed. The focus has also often been limited to individual sectors or areas of application (Winby and Mohrman, 2018, p. 422). For this reason, the idea of socio-technical approaches that the two components—and adjacent functions—must undergo coordinated further development is correct, but, as *Figure 2-15* aims to illustrate, is not sufficient for the question at hand.

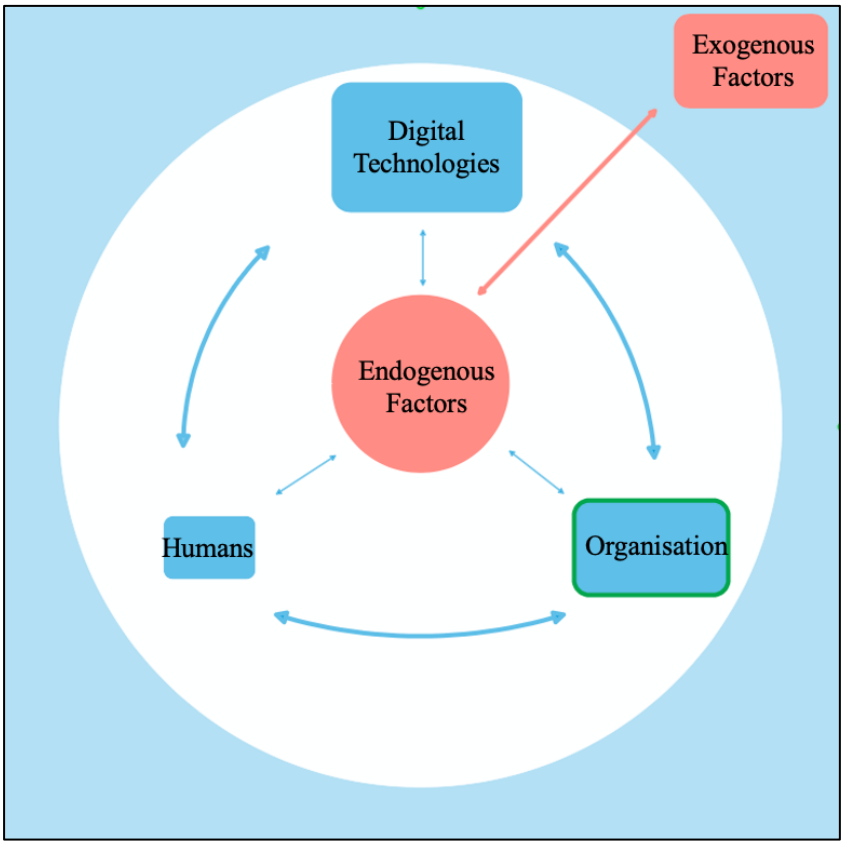

Figure 2-15: Area of impact 'Organisation—Organisation of the organisation—Socio-technical approaches'.

Area of Impact ‘Humans—Human-related Aspects’

The human part is a central element in the interplay of the determines in digital transformation. The explanations have shown that factors exist at the level of each individual that are important for successful change (Diller, Asen and Späth, 2020). Initial findings related to digital transformation and personality can be found. However, the results focus on a specific profession (tax advisors) in a specific region (Munich, Bavaria). The findings cannot be adapted as an explanatory approach due to a different underlying understanding of the phenomenon and the focus on the profession of tax advisors in Munich. However, they also show that the connection of the components is an important component for grasping the gain in knowledge sought here in its entirety. The aspect of motivation considers the fact that an intended action in a person is influenced not only by the personality (motive—from within) but also by the respective situation (Heckhausen and Heckhausen, 2008). These findings show gaps that are discernible in the conceptual framework presented with regard to the endogenous and exogenous factors, and it is not sufficiently addressed in concrete terms how exactly digital technologies impact, what characterises them and how they relate to individuals and their attitudes. Although adaptations to readiness for change and job performance on certain personality traits are available in existing research (Barrick and Mount, 1991; Vakola, 2004; Osmundsen, 2020; Fonseca and Picoto, 2020; Kocak and Pawlowski, 2021), they have not yet been explored in the dynamic and complex constructures of digital transformation in GM (see *Figure 2-16*).

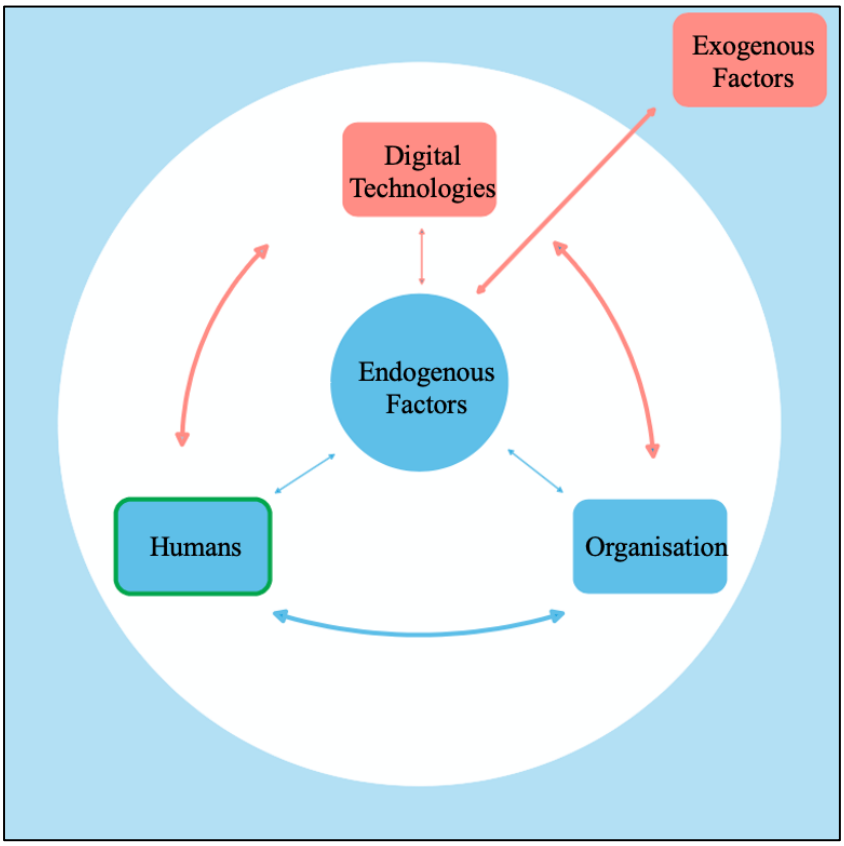

Figure 2-16: Area of impact 'Humans—Human-related aspects'.

Area of Impact 'Humans—Competencies'

In the area of competencies, it is possible to clearly demonstrate the topicality of the issue at hand and the prevailing gaps in the existing research. In the course of the literature review, the gaps and the need for a deeper examination of the digital transformation in GM have been shown from several perspectives. This need is illustrated by the study by Murawski and Bick (2017), who present the question of 'How will job profiles and required digital competencies change in the future?' and the associated recommendations to conduct 'qualitative research such as content analysis; interviews with domain experts and Delphi studies; case-study research; conceptual research; theory development' (Murawski and Bick, 2017, p. 730) in this area. This proves the need to place competencies at the core of the consideration, as derived and presented in this thesis (Osmundsen, 2020; Fonseca and Picoto, 2020; Kocak and Pawlowski, 2021).

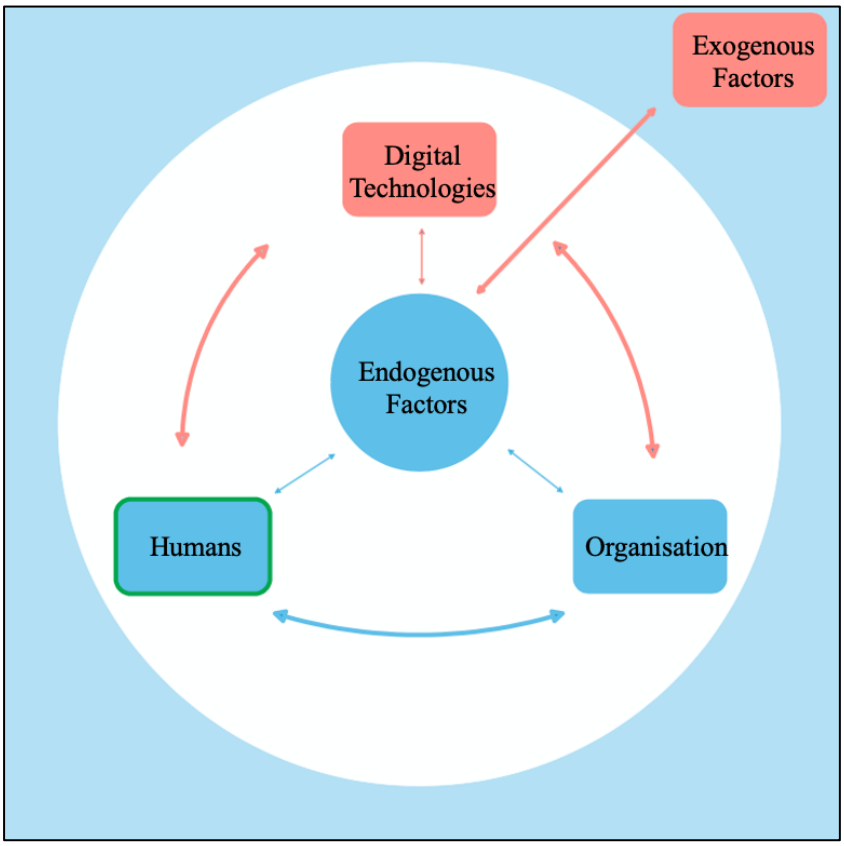

Figure 2-17: Area of impact 'Humans–Competencies'.

2.6.2 Implications for this Research

The literature review and the results produced provide valuable insights for the present study. A conceptual framework has been developed that makes the relevant determinants of digital transformation in German Mittelstand companies operationalisable. Guided by this, a literature search has then been conducted in the relevant areas, which has produced a variety of approaches to parts of the underlying RQ. At the same time, however, a review guided by the conceptual framework has shown where the gaps or weaknesses of the approaches are in detail. None of the concepts presented consider all relevant determinants with regard to the underlying understanding of digital transformation and with the focus on future key competencies in GM. Likewise, the prevailing dynamics in the construct are not sufficiently considered. The aim of this thesis is to take this holistic understanding as a basis to identify future key competencies in GM and to make them advanceable for business practice. The future competencies are at the core of this. In addition, human factors such

as personality and motivation are also considered, as the author is convinced that these are important for successful implementation. Since the human being is confronted with all the determinants presented, it is imperative that they be considered for the study.

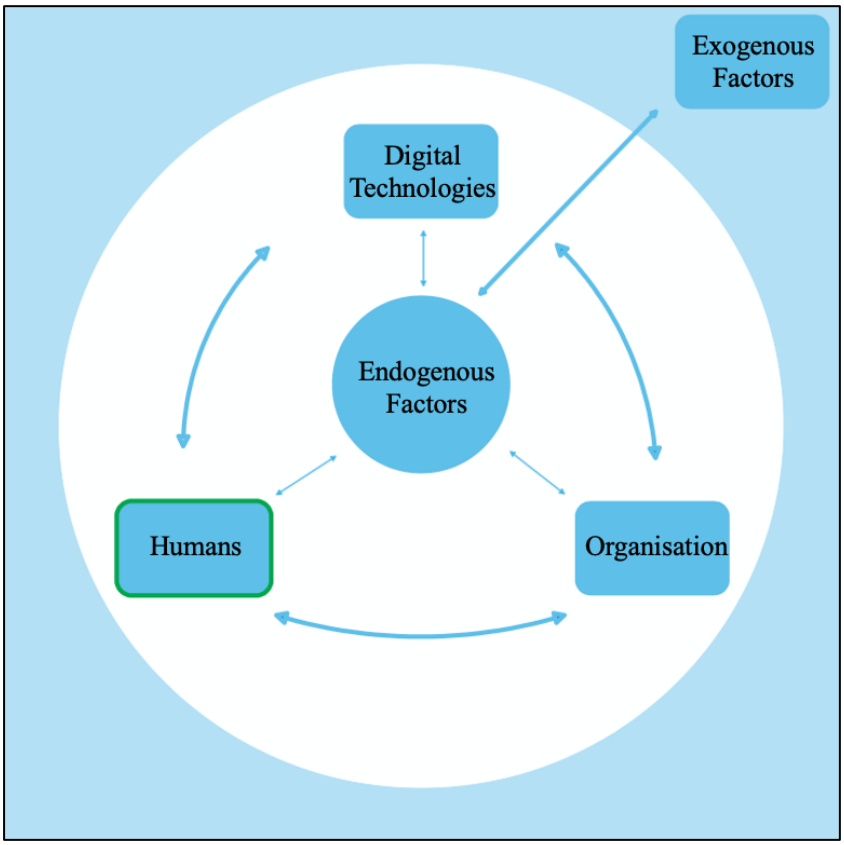

Figure 2-18: Implications of the conceptual framework for the research gap.

Accordingly, a complete picture of future key competencies for digital transformation can only emerge by considering exogenous and endogenous influences, the relevant digital technologies and a coordinated organisation. All determinants are hence considered in the phase of data collection to gain knowledge. The focus always remains on the human component, and especially on the competencies, in the understanding outlined above. The underlying research concept is designed to gain knowledge and follows this holistic approach to the phenomenon of digital transformation. This is finally applied to the conceptual framework underlying the literature review (*Figure 2-18*). It becomes clear that the determinants 'digital technologies', 'organisation', 'human', 'endogenous factors' and 'exogenous factors' per se are all considered for the fulfilment of the knowledge objective, as well as the respective interactions within the interaction. Therefore is also intended to consider the

prevailing dynamics of events. It would be too broad for this work to aim to explore all areas of impact equally. The approaches presented in the corresponding chapters show how diverse each individual area is. As such, although the holistic approach is necessary to satisfy the understanding of digital transformation, the gap that is to be closed with this work is limited solely to the advancement of future key competencies for digital transformation in German Mittelstand and to making them operational from a SHRM perspective.

3. Research Methodology and Study Design

3.1 Introduction

In the previous chapter, the individual components relevant to this research were discussed on the basis of existing research and brought together in a conceptual framework. The literature research has emphasised that no research to date has dealt comparably with the complexity of the digital transformation and the resulting demands on employees in GM, let alone provided strategies for advancing future key competencies. As such, such a new field of research cannot refer to or review existing findings; this chapter thus presents a research framework that is appropriate to the intended knowledge goal. It begins with the philosophical positioning and a research approach based on it. The chosen strategy, the Grounded Delphi Method (GDM), is presented, followed by an explanation of data collection and an introduction to data analysis. Finally, the role of the researcher and the quality of the study, as well as the research ethics, are discussed for this study.

3.2 Research Philosophy

3.2.1 Research Study Framework

The way the world is seen, how new knowledge is generated, guides an emerging research idea from the very beginning. Clarifying this is therefore an elementary step of any research project. This world view is called a paradigm and is defined as a ‘fundamental belief system based on ontological, epistemological, and methodological assumptions’ (Guba and Lincoln, 1994, p. 107). Guba and Lincoln (2005) add axiology ‘as an integral consideration in the context of a paradigm’. The terms ‘paradigm’ and ‘philosophy’ are used synonymously in the following.

The underlying research idea is to explore the digital transformation in German Mittelstand, to understand the phenomenon as well as its influences within organisations, and based on this, to identify which future key competencies will be needed in the future and how they can be advanced. Digital transformation is thus a phenomenon that influences the need for competencies. The advancement is being investigated for German Mittelstand. This implies that the research field is located in a

social context of the working world of people. Against this background, the positioning of the research in terms of the underlying philosophy, epistemology, ontology and stringently derived methodology for the research framework is to be argued.

The terms discussed here ('philosophy', 'epistemology', 'ontology' and 'methodology') are placed in different contexts and dependencies. Depending on the author and understanding, the interpretation of the terms may vary. This fact is the first challenge in defining one's approach (Crotty, 1998). Crotty (1998) offers an account and an explanation that repeatedly refers to the consistency and logic in the interaction of the elements. These basic elements of any research project are epistemology, theoretical perspective, methodology and methods (Crotty, 1998).

Another popular account and explanation, which also repeatedly refers to consistency and logic in the interaction of the elements, can be found in Saunders, Lewis and Thornhill (2009). In the form of the research onion, the argumentation is based on the underlying epistemology, ontology and axiology and goes through the layers of the onion, starting with the philosophy, through the approach, the strategy (which terminologically can be understood as methodology) and finally to the methodological implementation of the research.

The structures of Saunders, Lewis and Thornhill (2009) and Crotty (1998) show above all the dependencies and need for consistency. Nevertheless, it immediately becomes clear when comparing these two schemes that both the designations of the individual components and their connection to each other vary. For this work, the structure of Saunders, Lewis and Thornhill (2009) is adopted as a basis, and the corresponding terminology is used in the following.

For the classification of this work, the researcher has dealt with the basic orientations in the spectrum of research paradigms. The central research goal of advancing future key competencies for digital transformation in GM would in principle be possible under an objective, fact-oriented and generalisable world view, as given in positivism. Such ontological objectivity and epistemological generalisability would be accompanied by a detached and value-free axiology within the research (Saunders, Lewis and Thornhill, 2009; Merriam-Webster, 2019). For example, Duveneck et al.

(2021) used a quantitative Delphi study on the future of area-based initiatives in German education which evaluated the relationship between desirability and expectations and the degree of consensus or divergence amongst experts by means of statistical analyses of expert perceptions, which is valid for this purpose. However, from the researcher's perspective, this approach is not useful in the present context. For one thing, no evidence is currently available that would be sufficient for hypothesis testing. In addition, the researcher is convinced that the advancement of future key competencies, as will be elaborated in this study, depends on people's social reality. The underlying view is thus in strong contrast to a positivist understanding that assumes an objective and independent reality and postulates generalisable knowledge in the form of measurable facts. Knowledge that is valuable for answering the question only emerges in the meaning that results from the interaction of the subjects involved (Easterby-Smith et al., 2018; Saunders, Lewis and Thornhill, 2009). For this reason, a positivist approach is also not used to predict future competencies.

As a consequence of the considerations that speak against a positivist approach, an opposite positioning in interpretivism was considered. The subjective experience of reality leading to multiple meanings is closer to the researcher's perspective, but this ontological positioning is also not entirely correct for this research. As such, an adaptation of the interpretivism paradigm is not chosen for this research, as the researcher assumes that reality is socially constructed and not—as anchored in interpretivism—only subjectively created in a person to understand the individual person and their perceptions per se (Easterby-Smith et al., 2018; Saunders, Lewis and Thornhill, 2009).

In addition, a critical realist position is considered, since critical realism, like interpretivism, emerged as a critique of positivism. However, the critique of positivism's objective-analytical approach is met differently in critical realism than in interpretivism. Critical realism is often seen in the middle between positivism and interpretivism (Zachariadis, Scott, and Barrett, 2013). In critical realism, the generation of knowledge is conducted in several phases and therefore represents a multi-layered approach. (Saunders, Lewis and Thornhill, 2009). According to Fleetwood (2005), critical realism focuses on what we see and experience in relation to the structures of

reality that shape observable events. Research under a critical realist philosophy aims to create profound explanations and levels of understanding (Mingers, 2004; Zachariadis, Scott, and Barrett, 2013). For this research, a critical realist philosophy does not serve as a fundament, as the aim is to explore the phenomenon and the resulting actions for advancing the future key competencies in GM. The idea of knowledge as a social construct, however, fits very well with the context of this research.

These remarks clearly emphasise that a strong tendency can already be observed in the spectrum of research paradigms. The ontological and epistemological views underlying this work are presented below.

Ontology

The first question that is clarified specifically for this work is the nature of reality. According to the researcher's belief, there are multiple realities (Guba and Lincoln, 1994). The reason for this is that reality can only be understood in context; it is socially constructed through cultural, historical and social perspectives. There is no real world that is independent of human action (Saunders, Lewis and Thornhill, 2009). This ontological perspective seems appropriate for the investigation of the present RQ. The key competencies needed in the future will depend on the context of the organisation. The possibility of advancement for future competencies is in turn guided by the reality of an individual interpreting potential implementation actions in this context (Noonan, 2008).

Epistemology

Epistemology is concerned with the types of knowledge that exist and what knowledge the researcher defines as acceptable for the research project at hand (Saunders, Lewis and Thornhill, 2009; Crotty, 1998). In the context of this study, this means considering that the researcher cannot be separated from professional experience. As a digital transformation consultant, the researcher will make a reflexive interpretation of the data and bring her beliefs to bear. New knowledge is gained from the interaction of the researcher's experience and the perceptions and assessments of the study participants. The defined question serves to build theory through abstraction and

conceptualisation of the phenomenon in a shared construction of knowledge (Saunders, Lewis and Thornhill, 2009).

The research focuses on a critical examination of the question of what is required of people in GM with regard to the digital transformation and how the advancement of these requirements should be achieved in the future. The construct of the Mittelstand is unique worldwide (Welter et al., 2015; BVMW, 2020) and is based primarily on the self-image of the Mittelstand as the 'backbone and growth engine of the German economy' (Schäfer, 2004). This understanding is a socially accepted construct, especially in Germany. That it is a socially constructed understanding is made clear by the fact that there is nevertheless no uniform and precise understanding of the term (Wolter and Hauser, 2001; Kinne, 2009). The influences considered of digital technologies and exogenous factors are interpreted within the social construct of the organisation, under the self-image presented as a medium-sized company. The interactions and actions that occur in this context are based on this. They refer to the cultural beliefs, rules and practices that shape the behaviour and perspectives of individuals acting within this environment (Bossy et al., 2018.). Based on the preceding remarks on the conception of reality and the emergence of knowledge, the present research project is based on the paradigm of social constructivism.

3.2.2 Social Constructivist Paradigm

Social constructivism is based on understanding different realities that people have formed based on their individual assumptions. It also considers lived experiences and the associated social and cultural structures, which makes it extremely suitable for the context of GM (Burr 2015; Saunders, Lewis and Thornhill 2009). This view is guided by the fact that knowledge and reality are constructed in discourse and conversation between people. According to Magala (2002, p. 23), 'Social constructivism is a family of theories and methods in the social sciences that explain how individuals and groups "produce" social reality by creating meanings and interpreting relationships, interactions, and environments. Organisational theories of SC focus on communication flows, power asymmetries, and change processes'.

There is no single valid definition of social constructivism (Burr, 2015, p. 2). Instead, social constructivism describes theories that share one or more key assumptions at their core (Magala, 2002, p. 17; Burr, 2015, p. 2). These are essentially the theories listed in *Table 3-1* and applied and argued for in the present research context.

Table 3-1: Social constructivism - Central assumptions.

Social Constructivism Basic Assumptions	**Reference to the Research Project**
A critical attitude towards presupposed knowledge (Burr, 2015, p. 2)	The basic understanding of digital transformation and the expertise attributed to the study participants
Historical and cultural specificity: 'Concepts and categories we use are historically and culturally specific' (Burr, 2015, p. 3)	Guided by the understanding and characteristics of the Mittelstand; Characteristics of the owner and history within the individual organisation
Knowledge is maintained through social processes (Burr, 2015, p. 4): 'Ways of understanding the world are a product of social processes and interactions in which people are constantly in contact with each other' (Burr, 2015, p. 5)	Understanding through social processes is very complex due to a high degree of interconnectedness and many social processes (real as well as digital) and does not stop at the boundaries of a single organisation.
Knowledge and social action go together: 'Our constructions of the world are therefore also linked to power relations because they have implications for what different people are allowed to do and how they can legitimately treat others' (Burr, 2015, p. 5)	Critical consideration of individual perspectives and consideration of the prevailing power relations (e.g., expert is owner) (power) position of the individual actors concerned within the study/experts
Language as a prerequisite for thinking: 'The way a person thinks, the categories	Possible recommendations for action for the advancement of identified future key

and concepts that give him or her a framework of meaning, are predetermined by the language he or she uses' (Burr, 2015, p. 10)	competencies can lead to consequences for the language. Accurate analysis and critical reflection of the language used.
A focus on interaction and social practices (Burr, 2015, p. 11)	The recommendations for action to be developed as an implication of the identified key competencies to be developed are based on the interactions and social practices on which the experts base them.
A focus on the process dynamics of interaction; The focus is thus on processes rather than structures (Burr, 2015, p. 11)	The present structure is less relevant than the evaluation of future and present processes.

An inductive, qualitative research framework considers the assumption of multiple realities and the emergence of new knowledge through social construction. The proximity of the researcher to the context and the view that the meaning people attach to the context in their respective perspectives underline the justification for the inductive approach. This approach thus consistently pursues the overall objective of the thesis, namely the advancement of future key competencies for digital transformation in GM. This results in the choice of a qualitative approach. The character of the study pursues an explorative purpose and thus fits stringently into the philosophical positioning in social constructivism.

3.3 Research Strategy

3.3.1 Introductory Considerations on the Research Strategy

The philosophical foundations, as well as the inductive and qualitative approach presented, form the basis for the choice of research strategy. The researcher has considered possible approaches to the decision-making process. In detail, these include

the following: action research, case studies, constructivist grounded theory, and Delphi studies. These approaches were chosen because they can be used in real world situations and fulfil the requirements to fit into the research philosophy outline. The consideration of a strategy is guided by the goal of knowledge, as the best possible results should be generated from the research process. Likewise, good self-reflection on the part of the researcher is necessary, since in the context of a qualitative approach, no separation between the researcher and the research area is possible, as is the case with positivist approaches (Creswell, 2007; Saunders, Lewis and Thornhill, 2009).

Action research in this case does not fulfil the desired objective, as the research is not conducted in practice but aims to generate knowledge about future actions (Saunders, Lewis and Thornhill, 2009, p. 147). Furthermore, the researcher has deliberately chosen not to be interactively involved in the process. Although research is never objective under philosophical assumptions, active participation in the research process, as in action research, is not, according to the researcher, the best way to achieve the goal of knowledge. On the contrary, a danger exists that facets and ideas that a participant can bring to the table will be eclipsed or not even come to light by active engagement.

Another obvious strategy for this research is the use of a case study. Again, theories are formed from (usually qualitative) data to explore the dynamics of the related components for a particular case. For the present study, this approach has some weaknesses, which is why the researcher decided against a case study. First, these weaknesses are due to the usual methods of data collection (interviews, focus groups, observations). Conversely, German Mittelstand, while a possible case, is too broad and diverse in itself to serve as a meaningful basis for a case study. The same applies to individual companies from GM, which would not provide adaptable information in the sense of a case study.

In the context of the underlying RQ and the philosophical foundations, the use of constructivist grounded theory is obvious, as the goal is to construct theories from the collected data in a clear format (Mills, Bonner and Francis, 2006; Hammerschmid, 2020). Above all, the structured approach to data analysis makes sense for a complex object of investigation such as this one. However, given the requirements of this

research, this approach has weaknesses in terms of data collection, kike collecting data sequentially rather than all at once, which have ultimately led to the decision to pursue the Delphi approach further. This is because ‘while grounded theory aims at the discovery of an emerging theory, the Delphi method focuses on selected experts, their expertise, and anonymity amongst themselves, and the consensus they have reached… within the field of interest…’ (Päivärinta, Pekkola and Moe, 2011, p. 4). Against this background, the Delphi method is recommended for use in a new exploratory research area (Päivärinta, Pekkola and Moe, 2011).

The focus of data collection in this study is on the assessment of experts for a future scenario to generate ideas based on this, which can be embedded theoretically and will find practical implementation. The reason why the Delphi approach is classified as a strategy here is that the approach, similar to the three strategies described above, provides a framework and a clearly differentiated focus for gaining knowledge. On the other hand, the detailed procedure (i.e., data collection and data analysis) is not prescribed in a fixed sequence. As such, the Delphi approach—similar to, for example, a case study—offers the flexibility to combine individual methods of data collection and data analysis. In this way, for the present study, the goal can thus be achieved of identifying components and concepts that should be included with regard to future key competencies for the digital transformation in GM and, based on this, to identify possibilities for advancement. The predictive aspect and the possibility to address uncertainty were final deciding factors in choosing the Delphi study as the strategy (Häder, 2014).

The chosen research strategy is based on the Delphi method. The chosen design of data collection and analysis is examined within the framework of these preliminary considerations and used to make decisions about the research strategy. The terms ‘Delphi study’, ‘Delphi method’ and ‘Delphi approach’ are understood synonymously in the context of this work. There is no unanimous definition for any of the terms. Research on Delphi surveys reveals a diverse picture of understandings. For this reason, the following understanding is used: Delphi studies are characterised by the fact that they represent a controlled, decentralised group communication process on the one hand, and on the other hand, they serve to explore uncertain, often future circumstances

(Häder, 2014). A detailed discussion of the basic principles of Delphi studies is provided in Sub-section 3.3.2.1.

Delphi Studies in the Context of the Research Field

Different approaches and the flexible application possibilities of Delphi studies lead to a variety of results when reviewing existing studies with this design. To identify an adaptable approach for the present research context, a selection of studies was examined that address the context of digital transformation and/or the area of competencies. The aim is to use the approach chosen there as a reference for application in the present study or to distinguish it from it. In a cross-national comparison, it should be noted that there are different designs and objectives of Delphi studies. For example, the four types (Condensation of ideas; Establishment of a factual situation; Identification of expert opinions; Consensus) of Häder (2014), which are popular in German-speaking countries, do not seem to be widely established in the international context. In the first step, the search for published studies was limited to 2017–2021 to ensure relevance with respect to the purpose of the study and the methodological findings. The analysis of the studies with an indication of the knowledge objective pursued, the object of the study, and criteria for adaptability can be found in Appendix 3.1. *Table 3-2* provides a list of the analysed recent Delphi studies and gives an overview of the individual studies, their authors, year of publication and topic.

Table 3-2: Selection of recent Delphi studies in a broader research context.

Authors	Year	Topic
Kamsker, S. Digital Transformation and the Design of Curricula at Austrian Universities Delphi study on the development of curricula in business studies and business education	2021	Digital Transformation and the Design of Curricula at Austrian Universities A Delphi study on the development of business administration and business education curricula

Kranjc Horvat et al. Learning objectives of continuing education programs at scientific research institutions: A Delphi study with different stakeholder groups.	2021	A study to identify the main learning objectives of continuing education programmes at scientific research institutes from the perspective of four groups of stakeholders, namely teachers, educational researchers, government officials and academics
Uum, E. M. Entrepreneurial Behaviour in the Digital Transformation: A Focus Group Study on Entrepreneurial Qualities and Professional Identity of Employees in the Digital Transformation	2021	The aim of the research is to find out what managers can do to support their employees in developing these entrepreneurial qualities/professional identity. Data is collected through a Delphi study amongst employees in leadership positions who are tasked with managing change, resulting in management guidelines to support the development of entrepreneurial qualities.
Ökmen et al. A needs analysis on the competencies students should have for graduate programmes in curriculum and teaching: A Delphi study.	2019	The study aims to identify the competencies that graduate programs should possess and to review the courses and content taught in graduate programs based on these competencies.
Gajic and Palcic A new framework for complexity analysis in international development projects—results of a Delphi study	2019	Development of a framework to characterise project complexity in international development (ID) projects In a two-stage Delphi survey, a new framework was developed that builds on the existing TOE (Technology-Organisation-Environment) framework and incorporates new empirical findings from experts in the field of ID projects.
Cech and Tellioglu	2019	Research questions:

Impact of the digital transformation: An online real-time Delphi study		• Which areas of society will be most and least affected by the digital transformation in the next five years? • Which digital transformation topics need to be addressed most and least in the next five years? • What influence will the digital transformation have on the global challenges of the next five years? • Which technologies will have the greatest and least impact over the next five years?
Hodapp et al. Creating Shared Value in Emerging Platform Ecosystems: A Delphi study in the context of the Internet of Things	2019	To shed light on the challenges of co-creating value in emerging digital platform ecosystems, we are conducting a Delphi study with 21 experts from leading IoT (Internet of Things) companies.
Mthembu, Wegner and Roman Guidelines for the integration of spirituality and spiritual care in occupational therapy education: A modified Delphi study	2018	The aim of this modified Delphi study was to develop educational guidelines for the integration of spirituality and spiritual care in occupational therapy education.
Weibl and Hess The success or failure of Big Data: insights into the challenges for	2018	Based on technology assimilation theory, this study goes beyond a binary view of BDA adoption and describes crucial management challenges along the more complex assimilation process by conducting an

managers from a technology assimilation perspective.		exploratory and international Delphi study in collaboration with 21 experts.
Hartl and Hess The role of cultural values in digital transformation: insights from a Delphi study.	2017	Values-based approach to organisational culture to identify cultural values that are critical to the success of digital transformation.
White, G. R. Future applications of blockchain in business and management: A Delphi study	2017	Question 'How will blockchain change the future of the economy? The study seeks to gain insights by soliciting the findings of a panel of experts through a Delphi study, guided by the predictions in the limited existing literature.

The selection of studies shows that the approach of the Delphi method is a viable way for the question to be addressed. In contrast, the chosen analytical procedures, especially against the background of an adaptation of the analysis of qualitative data for this study, are not satisfactory, as there where used mainly statistical procedures (see in Detail Appendix 3.1).

For this reason, the researcher includes other modifications in the considerations whose publications predate the analysis period of 2017 or have a different thematic focus but are worthy of attention for this research, especially in the area of analysis of the collected data.

The publication by Brady (2015) appears as one of the primary results in the search for a 'qualitative Delphi study'. Brady (2015) locates the qualitative approach in the context of a pragmatic understanding of research with the 'aim of developing a theory of practice in community organising' (Brady, 2015, p. 2). For the analysis of the

data collected in the Delphi study, Brady suggests the use of thematic analysis, which can be found in various forms and applications, making it difficult to gain a clear understanding of its use (Brady, 2015). The thematic analysis procedure is one conceivable way of analysing the qualitative data of the study. However, a more structured approach is sought for this study so that other possibilities can be validated.

Sekayi and Kennedy (2017) take the variety of existing method descriptions as an opportunity to present a structured process that includes the intermediate steps of data analysis. The authors describe the steps of a qualitative Delphi study in four rounds using a concrete example. Qualitative data is collected in the form of brainstorming in the first round of the Delphi study. The results are then coded in three steps (open and axial coding according to Strauss, 1987) and processed into statements which are reported back to the experts in the second round. The statements are presented to the experts (in electronic form), who are also asked to comment on the statements. The feedback is then incorporated into the statements, but without significantly changing the original meaning of the statements. The adjusted statements are sent back again in the third round, with the requests that the experts rank their agreement with the statements presented in order of strong, moderate or minimal and that this ranking is in each case ‘accompanied by a description to clarify the meaning of the rankings’ (Sekayi and Kennedy, 2017, p. 2758). In the final, fourth round, the results are presented to the expert panel in the form of a list of statements rated moderate to strong, whereby the selection of the statements presented can be based on different criteria (Sekayi and Kennedy, 2017). In particular, the use of open and axial coding from grounded theory is interested in this approach. Such a modification has been initially introduced by Päivärinta, Pekkola, and Moe (2011) as the GDM and defined as follows:

The resulting [GDM] improves Delphi studies by introducing a data collection technique that explicitly focuses on identifying the reasons and consequences of problems that are assessed by experts. In addition, open- and axial-coding techniques support the discovery of theoretical concepts from the original Delphi questions. In turn, the ranking procedure of the Delphi method provides a rigorous means of selecting core categories for theory development, reducing the researcher's interference in this area. (Päivärinta, Pekkola and Moe, 2011, p.1)

Why Sekayi and Kennedy (2017) do not explicitly refer to the GDM remains unclear at this point. However, it is clear that this modification of a Delphi study is still a fairly new and rarely used approach (Howard, 2015; Higgins et al., 2021). The GDM integrates data analysis techniques of grounded theory and at the same time uses the principles of the Delphi method for data collection and the subsequent selection of core categories (Päivärinta, Pekkola and Moe, 2011). So, this approach of the modified Delphi method is further pursued for the research strategy and is presented in detail in the following sections.

3.3.2 The Grounded Delphi Method

3.3.2.1 Delphi Studies—Origin and Overview of Key Principles

The Delphi method is widely used, especially in the field of information systems (IS) research (Päivärinta, Pekkola and Moe, 2011). Following Linstone and Turoff (1975, p. 1), 'Delphi may be characterised as a method for structuring a group communication process so that the process is effective in allowing a group of individuals, as a whole, to deal with a complex problem'. However, the method is not sufficiently generally defined (Meißner, 2012, p. 165; Häder, 2014, p. 19). For this reason, the term 'Delphi method' is also used alongside 'Delphi technique', 'Delphi surveys' or 'Delphi study'. Since there are no clear demarcations that allow for a logical distinction between these terms, the variants are used and understood synonymously in this context.

The origins of Delphi methods date back to the 1950s. In this context, Kaplan, Skogstad and Girshick (1950) coined the term 'Delphi' in reference to the 'oracle' of future events (Kaplan, Skogstad and Girshick, 1950, p. 94, Meißner, 2012, p. 165). The first application is attributed to an American project sponsored by the US Army to make predictions for Soviet warfare based on selected expert opinions (Rowe and Wright, 1999, p. 354). Following Dalkey and Helmer (1963, p. 458), the method is therefore generally understood as a procedure to '…obtain the most reliable consensus of opinion amongst a group of experts… through a series of intensive questionnaires interspersed with controlled opinion feedback'. Since then, the Delphi method has been applied in many fields and discussed just as often (Rowe and Wright, 1999, p. 353). Due to the large number of applications and variations, it is not appropriate to discuss all forms

available in the literature. A consideration of the essential and most common approaches serves as a basis to show the applicability for the issue at hand and to derive the adaptation of the Delphi method.

Typical Applications

Guided by the respective expectation of results, different purposes can be identified for which the Delphi method is used. It is, for example, used as an instrument for anonymous structured group discussions. Implicitly, this application is about building consensus amongst the experts in the group. This structured procedure assumes complete equality in the weighting of individual opinions. By anonymising the feedback after each round, typical group dynamics should be avoided (Meißner, 2012; Häder, 2014).

In addition, the method is used as a forecasting tool for developments to be expected in the future. In such an application, the reaction to phenomena and events expected in the future from the experts' assessments is of central interest. In a forecast, therefore, the content-related purpose of the structured collection of expert opinions is in the foreground and not the formation of a consensus within the expert panel (Häder, 2014).

In both orientations, the use of expert opinions is common. The exact definition of an expert is the first challenge in the composition of the panel and is an elementary quality criterion of Delphi studies (Häder, 2014).

At the beginning, it must be ensured that a clear understanding exists regarding what the goal and intended gain in knowledge is through the application of the method. To be clear about this for one's own research project, it seems useful to first understand the classical Delphi approach.

The classic Delphi method can be delimited by six essential components and prerequisites (based on Rowe and Wright, 1999, p. 354 and Häder, 2014, p. 24):

- The creation and subsequent use of a questionnaire that asks for the experts' assessment of the question based on concrete criteria;

- Interviewing experts themselves using the formalised questionnaire;
- The anonymity of the answers given by the experts;
- The quantitative determination of the experts' group responses using statistical methods;
- Feedback on the group's answers to the experts; and
- Repetition of the survey as described (the number of repetitions depends on the previously defined goal, for example, consensus building).

At the beginning of this section, it was noted that the actual application of the method is often modified or parts of the classical approach just presented omitted or changed (Rowe and Wright, 1999; Häder 2014). From the multitude of different applications, Häder (2014) extracts four types which in his opinion form the basis for an applicable and methodological format (Meißner, 2012, p. 169, Häder 2014, p. 30):

1. Condensation of ideas (qualitative);

2. Establishment of a factual situation (qualitative and quantitative);

3. Identification of expert opinions (qualitative and quantitative); and

4. Consensus (quantitative).

The idea aggregation approach (Type 1) uses the expertise of the panel to develop problem solving proposals from the collected ideas. Unlike the classic approach, the results of the first round are not evaluated quantitatively by the experts in the following round but are reported back qualitatively. The experts can then comment on them again (qualitatively). These results are processed further with the aim of identifying as many ideas and approaches as possible from the expert panel. Consensus, or majority agreement, is therefore not a criterion in this approach. The number of repetitions of the survey rounds therefore depends on the quality and breadth of the ideas in relation to the question (Häder, 2014). The number of experts is usually lower under this approach. It is sufficient if an expert for a certain group or a certain

perspective is represented in the panel and thus takes several perspectives on the topic. The breadth of expertise is the quality criterion in this approach. However, it also applies to this approach that the selection and number of experts must be clearly justified and serve to achieve the RO (Häder, 2014).

Type 2 aims to determine an unknown question as precisely as possible in advance. This type thus represents the classic Delphi method. Type 3, the determination of expert opinions, aims at subjecting the different expert opinions to a quantifying evaluation to test the majority ability and thus to assess in the course of the survey whether an improvement of the expert opinions is actually achieved. Type 4, on the other hand, aims at harmonising a group opinion and thus puts consensus-building in the foreground. The continuation of the survey is orientated towards a defined value that the dispersion of responses must reach (Häder, 2014).

Criticism

Taking examples from history, the validity of individual experts can be questioned. One example is the assessment of Thomas Watson (1943, chairman of IBM), who predicted at the time that there would be a world market for five computers. Although this statement did not have a concrete time horizon, the error is obvious from today's perspective, even to laypeople. Consequently, even a panel of experts that reaches a consensus can be wrong. Consensus as a quality characteristic is therefore also controversial. As such, dissent as an outcome—always in relation to the research goal—can also represent a meaningful and usable result (Häder, 2014).

Furthermore, points of criticism of the methods are that they are frequently improper or lack professionalism and the resulting low significance of the results. In some studies, the classification of methodologically relevant criteria as an essential basis for finding results only occurs after the application and thus contributes little to the actual gain in knowledge (Linstone and Turoff, 1975; Rowe and Wright, 1999; Meißner 2012; Häder, 2014). Regardless of the exact procedure, further weaknesses can be attributed to the method due to how responses are collected. One of these is the time required, which must be considered in the iterative procedure. Furthermore, limitations in the quality of the answers are to be expected compared to classical interviews. Due to

the written response, spontaneous answers from experts are not expected. Additionally, before deciding on the method, the researcher must be aware that no facial expressions or gestures or other situational reactions of experts are available for the evaluation of the results (Häder, 2014).

The limitations and points of criticism are contrasted with the potential of the method. There are advantages of the Delphi method compared to an interview situation. Specifically, these are the little or no influence by the researcher, more time for the experts to answer the questions, a high degree of structuring of the answering process and the subsequent use of the results (even with a qualitative approach), the preservation of the anonymity of the experts (avoiding loss of face and increasing the likelihood of honest answers) and the targeted dissolution of cognitive processes in the experts through feedback and follow-up questions (Häder, 2014).

Considering the criticism of the method and the multitude of approaches and views that can be found, it is therefore important to know the limitations of this method for one's own project (as with any other method in the context of a scientific study). Likewise, when using the Delphi method, it is essential to clearly define the possibilities and the desired goal (Häder, 2014, p. 29). In the context of forecasting the future, an expectation that aims to predict the future as accurately as possible is therefore not well suited. Instead, it makes sense to record the experts' current assessments of the future prospects, qualify these further and derive conclusions and action strategies from them. According to Cuhls, Blind and Grupp (1998, p. 3), Delphi surveys 'thus do not simply provide a picture of the future, but an information basis for deciding what to do or not to do today' (Cuhls, Blind, and Grupp, 1998, p. 3). Following this view, the application of the Delphi method seems to make sense for the present work to achieve the desired gain in knowledge. To this end, the Type 1 aggregation of ideas (a qualitative Delphi study) described above is chosen for the present study. A panel of experts with different perspectives on the complex topic has thus been assembled to generate as many different ideas and suggestions for the RQ as possible. The criteria for an expert and the composition of the panel are presented in detail in Sub-section 3.4.1. The involvement of the experts and their assessments of the future key competencies for the digital transformation in GM make it possible to put the implicit knowledge of the experts into

an explicit result form and thus make the knowledge accessible for theory and practice (Kamsker, 2012).

3.3.2.2 Grounded Theory – Origin and Overview of Key Principles

In the context of the considerations from Sub-section 3.3.1, it has been described that GDM combines data analysis techniques of grounded theory with the data collection methods of a Delphi study (Päivärinta, Pekkola and Moe, 2011). A possible alternative for analysing qualitative data in a Delphi study is presented by Brady (2015), with thematic analysis. The considerations of following a highly structured approach to data analysis, as attributed to grounded theory in the original after Glaser and Strauss (1967), are partly due to the relative inexperience of the researcher. Additionally, a highly structured approach that stays close to the data ensures rigour in the course of the study (Corbin and Strauss, 1990; Strauss and Corbin, 1998; Hammerschmid, 2020). This rigour was one of the guiding ideas in the original grounded theory of Glaser and Strauss (1967), which integrated the logic and rigour of quantitative methods into qualitative data analysis with the aim of identifying theoretical constructs from qualitative data. Accordingly, it is 'the discovery of theory from data (that) are systematically collected and analysed in social research' (Glaser and Strauss, 1967, p. 1). Methodology has provided tools for conducting qualitative research, such as primarily coding data and materials, as a central process of grounded theory, which makes the approach relevant to qualitative research (Flick, 2009; Päivärinta, Pekkola and Moe, 2011; Howard, 2015). From the original variant according to Glaser and Strauss (1967), several different manifestations have emerged over time. These differ in their starting points and pursue different approaches to grounded theory (Flick, 2009). Currently, three main approaches can be identified: the 'classical' Glaserian approach, the structured approach according to Strauss and Corbin and the constructivist approach of Charmaz (Hammerschmid, 2020). These three versions differ primarily in the central element of the coding. Similarly, the underlying philosophical position is classified differently by the representatives of the different approaches (Howard, 2015). For this thesis, the view of Urquhart, Lehmann and Myers (2010) is followed, that 'the researcher's own ontological and epistemological position has an influence on the coding and analysis of data and the way they apply grounded theory' (Urquahart,

Lehmann and Myers , 2010, p. 361). Accordingly, the researcher's world view, as outlined in Sub-section 3.2.1, can also be followed by using an analysis of the qualitative data according to the coding principle of grounded theory. Coding in the context of grounded theory is referred to as the '… process of developing codes, categories, and concepts as coding' (Flick, 2009, p. 435). The different views on coding and categorising by Strauss and Corbin (1990), Glaser (1992) and Charmaz (2006) are not relevant for the present work (a clear presentation of the differences and connections can be found in Hammerschmid, 2020). It is much more the common core of the method, namely the process of coding in several steps, that is considered as the basis for the analysis in the context of the research (Flick, 2009). Coding means that properties, categories and their relationships to each other are developed from the qualitative data (Päivärinta, Pekkola and Moe, 2011). To introduce clear terminology for the coding process steps in the context of the work, the terms 'open coding', 'axial coding' and 'selective coding' are used in the following course.

Open Coding

The starting point—open coding—serves to identify, describe, name and classify the main ideas and phenomena in the data at hand (Flick, 2009; Päivärinta, Pekkola and Moe, 2011). This analytical process can be applied at different levels of detail. The level of detail can be at the level of a word, line, sentence or paragraph. When the individual words or statements of a respondent are adopted as coding, these are called 'in vivo codes'. The codes assigned can be single words or short sequences of words that adequately describe the content of the passages thus marked within the qualitative data (Strauss and Corbin, 1990; Flick, 2009). The level of detail used for the coding depends on the context of the individual study and the corresponding significance, as well as the goal of the coding (Howard, 2015).

Axial Coding

With the step of axial coding, the codes from the open coding are refined, further differentiated and connected in categories to gain a more profound understanding of the relationships and connections underlying the data (Flick, 2009; Päivärinta, Pekkola and Moe, 2011). This development of relationships and categories is done both

inductively—by identifying concepts from the text at hand, in this case the responses of the study participants—and deductively—by checking the developed categories against the text (Strauss and Corbin, 1990; Flick, 2009). A ‘coding paradigm’ can be used to formulate the identified relationships of the codes. This applies specific questions from different perspectives to the categories to shape the process of refining and developing the categories (Flick, 2009; Howard, 2015). The use of a coding paradigm is not mandatory in the structured analysis of data in grounded theory and can also cause difficulties for inexperienced researchers (Urquhart, Lehmann and Myers, 2010).

Selective Coding

Selective coding, which follows axial coding, occurs at a higher level of abstraction and substantiates the relevant categories with further examples from the data, thus forming core concepts (Flick, 2009). In this process step, the actual theory is developed in grounded theory, which identifies and reveals the story of the central phenomenon (i.e., the core themes; Päivärinta, Pekkola and Moe, 2011). The focus is more on the development of general concepts than on the accuracy of the data. Selective coding is supported by notes taken by the researcher during the coding process (Strauss and Corbin, 1990). The process described above ends as soon as theoretical saturation has been reached (i.e., no new insights emerge even after the inclusion of further data or additional enrichment of the categories; Flick, 2009).

Despite the relevance of grounded theory for qualitative research, as described above, some criticisms of the method exist. The method was developed with the purpose of establishing and identifying theories, which has been applied sufficiently in few studies to date (Urquhart, Lehmann and Myers, 2010). As a result, grounded theory is primarily seen as a coding method (Päivärinta, Pekkola and Moe, 2011; Howard, 2015). For the present study, therefore, grounded theory does not represent a methodological basis but rather provides the necessary structured contribution for an analysis of the qualitative data with regard to the coding procedures that have been described.

3.3.2.3 Grounded Delphi Method

The previous review of the components of the GDM, the Delphi Method and grounded theory has outlined the strengths and, more importantly, the weaknesses of each method for use in exploratory research (Howard, 2015). This has motivated the approach of Päivärinta Pekkola, and Moe (2011), which extends the Delphi research method with data collection and analysis techniques from the grounded theory research tradition to improve theory building (Päivärinta, Pekkola and Moe, 2011). The combination of key elements from the Delphi method and grounded theory is intended to broaden the scope of both methods and compensate for weaknesses (Howard, 2015). Päivärinta, Pekkola and Moe (2011) cite '… increasing the stringency of theory building in Delphi by following grounded theory principles in the data collection (through theoretical sampling) and analysis (open, axial and selective coding) stages' (cited from Howard, 2015, p. 112).

To date, the GDM has not been widely used. It was applied for the first time in the research project by Päivärinta, Pekkola and Moe (2011) and named GDM. In addition, two dissertations can be found that follow Päivärinta, Pekkola and Moe in their application of GDM. One is Hussey (2012), whose dissertation addresses the integration between intuitive and logical decision-making processes through prayer. Second, Katherine Howard (2015) used the GDM in her dissertation and investigated the skills, knowledge, qualities and training needs of information professionals in galleries, libraries, archives and museums in Australia. More recently, Higgins et al. (2021) also used GDM to define autistic burnout from experts' own experience. An overview of recent GDM studies is provided in Appendix 4.4.

For the possibility of using the GDM to go beyond the predictive power of the Delphi method and thus beyond the intended theory building, Päivärinta, Pekkola and Moe (2011) incorporate Okoli and Pawloswki's idea of asking the participating experts to justify their perceptions and thus provide additional explanations (cited in Päivärinta, Pekkola and Moe, 2011, p. 2). This advice was included for the first round data collection in this study and is explained in detail in sub-section 3.4.2 as part of the development of the survey instrument.

3.3.3 Rationale for Selecting the Grounded Delphi Method in Context of the Research

Research strategy is a fundamental component of any research project. It must not only stringently serve to answer the underlying RQ but must also be embedded in philosophical understanding (Howard, 2015). The modification of the Delphi method chosen here, the GDM, provides an adequate framework for the present research project to achieve the desired goal of knowledge and the presented complex framework in which this research operates, while at the same time complying with the underlying philosophical understanding.

Based on the assumptions of social constructivism, knowledge is created by people in their social reality and maintained through social processes (Burr, 2015). This also applies to knowledge constructed by experts in their respective social interactions and realities. This knowledge is contributed by the experts in the context of this study. Through the application of GDM, the socially constructed knowledge of the experts is discussed in the expert panel and brought together in the form of statements and agreement with the statements. Again, knowledge is generated through interaction, but, due to the method used, asynchronously. This is to avoid power relations within the expert panel itself and within the interaction with the researcher, as constructions of the world are also always linked to power relations, which "have implications for what different people are allowed to do and how they can legitimately treat others" (Burr, 2015, p. 5).

The Delphi method—assuming a methodologically sound application—offers the possibility of modification to take account of the circumstances of the underlying RQ. This flexibility is particularly important when the question is based on incomplete knowledge about a problem or phenomenon. (Rowe and Wright, 1999; Skulmoski, Hartman and Kran, 2007). Furthermore, it is possible to conduct the expert interview, as a group discussion process, online and thus completely independent of location, which prevents geographical restriction and—in times of the current COVID-19 pandemic—does not prevent access to experts despite all restrictions. Another advantage is that the experts remain anonymous amongst themselves, counteracting dynamics in the results of the group statements. In addition, each individual expert can allocate their time to

answer the questions, which can reduce the dropout rate due to lack of time resources on the part of the experts.

On the other hand, by using the coding of qualitative data according to the principles of grounded theory, a structured way of theory building can be achieved. The approach through a qualitative approach is justified by the state of research so far with respect to the context and understanding of the phenomenon.

The Delphi method allows for a structured way of collecting data and is equally open and flexible to generate new knowledge. Feedback of the experts' answers after the first round ensures that additions or clarifications of understanding can be made from the ranks of the experts, which improves the quality of the data. In addition, the different perspectives of the various experts allow for a deeper elaboration of the questions. The inclusion of experts who each represent a different focus in their perspective than the conceptual framework presented allows for a more comprehensive view and, therefore, promises more and deeper results for advancing new key competencies. In this way, the claim that the holism of the complex phenomenon is addressed for interpretation can be fulfilled. Likewise, the dominance of individual opinions and possible power imbalances within the circle of experts is prevented by the anonymity of the experts amongst themselves, although a group discussion occurs within the chosen approach.

The results can reveal new key competencies that have not been considered so far. From the experts' perspective, a theoretically sound and simultaneously practically feasible approach for organisations can emerge that enables employees to adapt the identified new requirements in the form of key competencies for a future, digitally transformed working world. The structured way of evaluating the data is made possible by open, axial, and selective coding, as a basis for the experts' statements. In the second round, the statements are checked against the expert panel by means of agreement or disagreement, so that good quality of the results is ensured.

3.4 Conducting the Grounded Delphi Method

3.4.1 Study Participants

3.4.1.1 Sample Selection

As far as the number of participants is concerned, the existing literature on the Delphi method, regardless of the application in detail, offers very different information on the necessary or most useful number of experts. The number for this type of Delphi study, which is comparable to qualitative or modified Delphi studies, ranges from 6 to 40 participants (Häder, 2014). Since a qualitative approach is taken in this study, there is no critical sample size to consider, as is common with quantitative methods. Additionally, an adequate density and depth of information can be achieved through several rounds of feedback on the questionnaire. As such, in this study, a number between 20 and 30 experts is used as the basis for the survey.

The criteria for selecting the experts result from the RQ and the RO (Jünger 2011). However, in light of the background of qualitative design, it is useful to refer to existing references to qualitative sampling. According to Patton (2002), the preselection of potential participants based on defined criteria is a common strategy to identify information-rich cases and to use limited resources effectively (Patton, 2002, p. 18). As such, for the selection of the expert group for this Delphi study, on the one hand, the strategy of maximum variation sampling was applied, as the aim is to interview as heterogeneous a group of experts as possible to find central themes. The selection was also based on previously defined criteria from the conceptual framework. In other words, an expert must have good expertise in at least one of the areas (endogenous perspective/exogenous perspective/digital technologies/process/human) of the conceptual framework. Thus, according to Patton (2002), selection is a mixed purposive sampling, as several strategies are combined. For the present research project, participants must have experience in the field of digital transformation and a solid focus on at least one of the determinants (‘digital technologies’/‘organisation’/‘people’/‘endogenous factors’/‘exogenous factors’) of the conceptual framework.

3.4.1.2 Criteria for an Expert

The participants (experts) are adult persons who are either currently employed in a company that corresponds to the definition of GM from Sub-section 2.4.1.2, were previously employed in such a company or are active in a Mittelstand association. These, mostly politically independent, associations cater for all commercial branches and professions, and represent the interests of small and medium-sized businesses in politics, with administrative authorities, with trade unions and with major companies (BVMW, 2022).

The respective organisation is not subject to any industry restriction. The number of employees and other quantitative and qualitative criteria are the result of the underlying understanding of GM.

Experts should distinguish themselves in their expertise by having points of contact with digital transformation in the course of their professional activities. This should be characterised by the fact that they possess the following characteristics:

- Have direct responsibility for digital transformation measures; and/or
- Have personnel responsibility and in this context are responsible for changes through the digital transformation in the previously defined sense for their employees; and/or
- Be active in supporting and advising GM as an expert of an association of the Mittelstand.

The composition of experts is intended to be heterogeneous according to the above criteria and that at least one expert per perspective of the conceptual framework (‘digital technologies’/‘organisation’/‘people’/‘endogenous factors’/‘exogenous factors’) has in-depth knowledge (Häder, 2014).

Due to the criteria mentioned above for participating experts, a targeted acquisition of experts is necessary. Through many years of voluntary work, including with Junior Chamber International (JCI) and through membership in Federal Association of Mittelstand Companies (BVMW), the researcher has a large network of

relevant personal contacts. Organisations or gatekeepers are not required for access to contact information. This way of acquiring experts brings with it the strength of being able to approach a relatively large circle of experts to ask them to participate. A disadvantage of the personal network can be that people are approached who are close to those of the researcher in terms of their experience, fields of activity, and world-view, which could potentially compromise broad and differentiated responses. However, since the experts are generally experienced personalities, it can be assumed that the answers will give a differentiated reflection of the perception, since the proximity to the researcher is not given in everyday experience, and no personal exchange takes place due to the nature of the survey.

3.4.1.3 Participating Experts

Based on established criteria, persons from the researcher's personal network were approached who corresponded to the understanding of an expert, as outlined in Sub-section 3.4.1.2, for the context of the study. A total of 41 people from the network were identified. The individuals were each assigned a perspective based on the conceptual framework. According to Häder (2014), it is necessary and at the same time sufficient for a qualitative Delphi study that pursues the purpose of idea generation that each of the relevant perspectives is represented at least once in the expert group. As such, this assignment is of interest for the selection and overview of the expert group.

The researcher attempted to achieve as even a distribution as possible of the perspectives represented amongst the experts through targeted approaches. Not all the 41 possible experts were reached during the acquisition phase. Some were unsure whether the time commitment was feasible for them at this stage, and therefore asked for information, but did not give a verbal commitment to participate. Of the 25 experts who verbally agreed to participate, all 25 confirmed their participation, formally, by signing the consent form. The ethical aspects related to study participants and their acquisition were reviewed and approved by the university ethics committee as part of the ethical approval process (see Appendix 3.2). Further ethical considerations are presented in Section 3.8.

3.4.2 Round 1: Open-ended Online Questionnaire

3.4.2.1 Preliminary Considerations on the Method of Data Collection

In Sub-section 3.3.1, on research strategy, the Delphi method, was subjected to a critical comparison with other options, such as constructivist grounded theory and the case study. In the literature, no clear distinction exists between considering it as a strategy as described above and classifying it as a method of data collection. For this research framework, it is considered a strategy because the various data collection methods used in many studies are not, in themselves, a feature of a Delphi study. For example, a first round of questioning is often conducted using semi-structured interviews, open-ended questionnaires or focus groups, as is also the case, for example, in Howard (2018), who adopts a similar approach to that used in this thesis for GDM. As such, this sub-chapter presents a delimitation and a rationale for the chosen method of data collection.

On the one hand, expert interviews were considered to generate new knowledge together with experts to answer the RQ. Furthermore, the use of focus groups was also considered. Finally, the implementation of data collection through anonymous group discussion within the framework of an open online questionnaire was examined for the Delphi study. The use of interviews or focus groups has some advantages that would be appropriate for both the epistemological objective and philosophical position of this thesis. However, at the same time, both methods have disadvantages, especially in the context of the current global pandemic situation and the associated limitations of face-to-face meetings of several people. Furthermore, the requirements of generating sound expert knowledge, conducting a group discussion and preserving the anonymity of the experts to avoid positions of power cannot be met simultaneously (Häder, 2014). In direct comparison with the points just mentioned, the advantages of an online open-ended questionnaire for data collection of the Delphi method outweigh the disadvantages that such an approach entails (Jankowicz, 2005; Flick, 2009; Saunders, Lewis and Thornhill, 2009; Häder, 2014). *Table 3-3* outlines the strengths and weaknesses of the three data collection methods:

Table 3-3: Strengths and weaknesses of the selected data collection methods.

Interviews (in-depth expert interviews)	
Strengths	Weaknesses
• **Include verbal and nonverbal responses** • **Spontaneous responses possible** • **Receipt of incoming enquiries** • **Omitting 'unnecessary' questions in the individual interview**	• Limitation by geographical factors (especially in the case of pandemics) • Less depth in the answers, as complex relationships may not be fully grasped spontaneously. • Less honest answers due to the personal situation • Time and cost intensive Online interview: • Lack of insight into nonverbal situations • The advantages of personal interaction are lost.

Focus Groups	
Strengths	Weaknesses
• **Give clues to the underlying attitudes and beliefs of the participants** • **Non-verbal communication and vibrations in the group are part**	• Place and time require a lot of coordination. • Power relations within the group can distort the results. • Can become unstructured,

of the investigation. • **The opinion-forming process can be observed.**	resulting in countless data with little content

Open-ended Online Questionnaire	
Strengths	Weaknesses
• **Independent of location (pandemic, region, travel effort)** • **Structured** • **Anonymity of the group amongst themselves (therefore less need for conformity)** • **Targeted triggering of cognitive processes in experts through feedback and re-questioning** • **More time to answer complex questions** • **Less costly** • **Fewer influences of the researcher** • **Exchange of information by digital means** • **Can be done in writing, online**	• Can be more time-consuming due to iteration • Spontaneous responses are not to be expected. • No inclusion of facial expressions and gestures • The situation is not known when answering the questions in the assessment, and no interpretation is possible.

The comparison of the methods has shown that for the requirements of this study, the Delphi method, in an adequate methodological implementation, has the most advantages for data collection. The decisive factor for the decision for the chosen method was, on the one hand, the preservation of the anonymity of the experts amongst themselves, so that possible power imbalances or dominance of individual experts would not have a disproportionate influence on the results. However, data collection was to be conducted in the form of a group process so that there would be no 1:1 interaction with the researcher during data collection. Another type of group discussion would have been very limited—apart from the aspect of anonymity—given the still limited possibilities due to the COVID-19 pandemic. In addition, a meeting of the participants (experts in this case) would have been logistically complex and very costly and time consuming for all sides, which would have represented a considerable risk for successful implementation.

3.4.2.2 Development of the Questionnaire for Round 1

The content of the questionnaire must meet several requirements (Häder, 2014). On the one hand, the questions must be clear and meaningful for the expert group so that the experts do not misunderstand them and the answers are useful later on. Second, the questionnaire must be in an open form, as the aim is to generate qualitative data. Finally, the questionnaire is the means by which the researcher, guided by the RQ, can generate data that is useful in achieving the knowledge objective (Howard, 2015). The data generated is basic to achieve the aim of this thesis, and the quality of the results is crucial to the findings of the study. To remain in a consistent context, the questionnaire is divided into five main sections.

In the first section, as is usual in a qualitative study, demographic and job-related information about the expert is requested. In addition, the first section also asks for a self-assessment of their expertise in digital transformation, which later is considered when interpreting and arguing the results to be able to check the respective expert status against the criteria mentioned in Sub-section 3.4.1.2 (Häder, 2014). The results of this section of the questionnaire are not included in the statements that are reported back to the experts for the questionnaire round of the study but are instead used exclusively by the researcher to assess the expert status of the participants in the panel.

The following statements are to be made by experts:

- How old are you? (Indicate in the following age ranges)
    - Under 20 years
    - Between 20 and 29 years
    - Between 30 and 39 years
    - Between 40 and 49 years
    - Between 50 and 59 years
    - Over 60 years
- Are you currently working in a German Mittelstand company? If not, what connects you to German Mittelstand?
    - This information is used to check the reference to German Mittelstand.
- How long have you been in your current position?
    - By means of this question, an indication of the experience is to be obtained.
- Now I would like to ask you to specify your professional field of activity in connection with the digital transformation in two to three sentences.
    - To ensure the status of the expert in the context of this study, this self-assessment of one's own experience is used as a check of the status of the expert.
- How do you classify your expertise in the areas of digital transformation (e.g., technology, process design, human resources development, strategy, legal and political expertise)?
    - A self-assessment by the experts to verify expert status.

The second section focuses on the complex area of digital transformation and is divided into two subsections. Here, the focus is on the assessments of future changes. This second section provides information on the assessment of the change in processes and working environments in the next 5–15 years and beyond. Furthermore, this section serves to put the expert in a future scenario and, with this mindset, to be open to ideas and assessments for the following two sections of the questionnaire. The questions in this section are based on the implications from the literature review. For example, Question S21a refers to the fact that Absenger et al. (2016) stated that digital technologies will bring about change in all areas of organisations and the economy, as described in Sub-section 2.3.2. Question S21b stems from the findings and reflections on BPR and socio-technical approaches, which have a strong process focus (Sub-sections 2.4.3.1 and 2.4.3.2). The aspect of cooperation in Question S21c is taken from the explanations on digital technologies in Sub-section 2.3.1 as well as from the impact of digital transformation and partly from the considerations on work design in Sub-section 2.4.3.2. To give the questionnaire a clear forecasting character, the time component of 15 years and beyond is included in Questions S21d and S21e. In the first area of the second section, the following questions are therefore to be answered by the experts with two to three sentences each:

- **S21a:** What is your general assessment of the development of digital technologies in the next 5 years? Please describe a possible future scenario for you.

- **S21b:** What do you think the processes will look like in 5 years in general due to the development of digital technologies?

- **S21c:** What do you think collaboration will look like in 5 years in general due to the development of digital technologies?

- **S21d:** What would you add or change in your answers regarding development in the next 15 years?

- **S21e:** What would you add or change in your answers regarding a development beyond the next 15 years?

The second area of the second section asks about the specific forecasts for GM and includes internal and external aspects. To cover the perspectives of the complex phenomenon of digital transformation in GM defined earlier in the conceptual framework, the questions are specifically aligned with the endogenous and exogenous views from Sub-sections 2.4.1 (Question S22b) and 2.4.2 (Question S22a). In addition, as a starting point, an understanding of the current influence of digital technologies in the company of GM should be achieved (Questions S22c and S22d). Here, too, a forecast of future developments is required, but specifically in GM (Questions S22e and S22f). In addition, Question S22g gives the experts the opportunity to add further aspects that did not fit the questions so far but could be relevant for the context in their opinion.

- **S22a:** Which external influencing factors are directly related to a digital transformation in your company?
- **S22b:** Which internal influencing factors are directly related to digital transformation in your company?
- **S22c:** What influence do digital technologies already have on your work processes today, and why?
- **S22d:** What do you think the work processes and cooperation in your company will look like in 5 years?
- **S22e:** What would you add or change in your answers regarding development in the next 15 years?
- **S22f:** What would you add or change in your answers regarding a development beyond the next 15 years?
- **S22g**: Do you have further thoughts and ideas in this context that have not yet fitted any of the questions? Then feel free to write them down here.

The third section of the questionnaire focuses on people in the digital transformation and asks experts to provide information on essential and outstanding

competencies in the context of the previously described change through digital transformation in GM. These two questions are strongly based on Boyatzis' (2008) understanding of competency, which was used as the basis for this work in Sub-section 2.5.2 and which basically assumes that there are threshold competencies and those that promise outstanding performance (Boyatzis, 2008, p. 7). The experts are asked to name and describe the two to three competencies that enable them to excel in a digitally transformed future working world.

- **S3a:** Explain the three to five key competencies that you consider essential for workers in general to be able to work in a future, digitally transformed world of work.

- **S3b:** In your opinion, what are the two to three competencies that promise excellence in a digitally transformed world of work (regardless of a single job role)?

Finally, the fourth section asks for concrete recommendations for action to enable people to develop the necessary and outstanding competencies. These questions have both procedural aspects ('Which is the first necessary step to advance…?') and evaluative aspects ('Which is the most basic…?'). In addition, the question about possible obstacles attempts to find possible confounding factors that could hinder the later advancement of key competencies. These questions therefore are meant to gather insights for the formulation of recommendations for professional practice and answering the RQs.

- **S4a:** In your opinion, what is the first necessary step that should be taken to develop the competencies of employees in the way you describe for the future digital transformation in your company/in German Mittelstand and why?

- **S4b:** What do you consider to be the most fundamental competency that employees should possess in a future digitally transformed working world, and why?

- **S4c:** Where do you see obstacles in the development of the mentioned competencies amongst employees and why?

- **S4d:** What contribution to development can or must the individual employee make? Please describe and justify your assessment as accurately as possible.

- **S4e:** Do you have any further thoughts and ideas in this context that do not yet fit any of the questions? Then feel free to write them down here.

The first questionnaire thus aims primarily to generate rich information from the panel of experts with various aspects previously described as relevant, to use this database to lay the foundation for answering the underlying RQs.

3.4.2.3 Pilot Test

Before the actual data collection, a pilot study should provide information about the comprehensibility of the questionnaire, for both quantitative and qualitative studies (Schreiber, 2008). A characteristic of pilot studies—in some cases also referred to as pre-test (Häder, 2014)—is that the actual study is conducted beforehand with a shorter duration and a small number of participants. The pilot of a study can serve several purposes. For the application case at hand, the prior test by means of a pilot study is intended to check the clear comprehensibility of the questions (Lancaster, Dodd and Williamson, 2004; Schreiber, 2008). The test also enabled the researcher to better estimate the completion time, which was communicated to the participating professionals in advance as a guide (Schreiber, 2008; Häder, 2014).

The pilot test was conducted with two people from the researcher's company. The selection of the participants was based on their professional background, because an important requirement is that they understand the questions from an expert's point of view. The two colleagues were asked to read the questionnaire but not to answer it. They were asked to put themselves in the shoes of a participant and comment on ambiguities with the first thought that came to their mind, using the comment function of Microsoft Word. In addition, the testers were asked to send additional comments or questions to the researcher after reading so that the researcher could critically check the understanding and structure again based on this feedback. The feedbacked comments were to shorten the questions or eliminate inadmissibility in individual formulations. In some cases, however, the questions that asked about two aspects should be formulated as two individual questions. These modifications were made by the researcher and

included in the final questionnaire.

3.4.2.4 Procedure of Data Collection in Round 1

The following procedure results from the data collection considerations presented in Sub-section 3.4.2.1. The questionnaire presented in Sub-section 3.4.2.2 was sent to the experts digitally—via the LimeSurvey platform, a German provider that enables surveys of various kinds via a cloud service. The provider is well known in German-speaking countries and is often used in the university environment as well as for market research purposes, so that this aspect also speaks for the choice of the provider, since the experts most likely already know the service of LimeSurvey. Furthermore, the platform offers the possibility to design the survey very flexibly according to the respective requirements. It is also possible to send the survey link directly from the application to the participants. Only the researcher can then—as in a 1:1 exchange, for example via email or in person—assign the results to an expert. During the evaluation of the results and the return of the group results, the anonymity of the experts amongst each other, as well as with regard to publication, is of course preserved. For reasons of anonymity, there was thus no contact between the experts. Each expert answered the questions at their own pace and without coordination with other experts or the researcher. The experts had 14 days to answer the first questionnaire through their LimeSurvey access link. It was estimated that the first questionnaire would take 45–60 minutes to complete. The results of the individual survey are analysed qualitatively—as described in Sub-section 3.3.2—and flow into the next survey round as anonymised group results. As described for the first round, the next round of survey was also conducted with LimeSurvey. In contrast to the classic Delphi approach, the results are not evaluated by the experts in the second round exclusively by agreement or disagreement, in a quantifiable way, but can be commented on again (qualitatively). This feedback is to be understood as a feedback mechanism that the experts can use in each subsequent round of questioning as a corrective to their perception but do not have to (Cuhls and Kimpeler, 2008).

3.4.3 Round 2: Online Questionnaire – Statement Catalogue

The development of the questionnaire for the second round of the GDM is presented in detail in Sub-section 4.3.1, as the questionnaire is based on the results of the first round. Basically, the procedure for the second round was conducted with the same expert panel. The timeframe for the feedback remained 14 days in the second round to give the experts, who are all busy in their respective professions, enough time to answer and reflect on the results and the answers. With the second round, the group statements generated from Round 1 were evaluated and commented on by the experts to deepen the insights from the data based on them and to obtain a good basis for the later answering of the RQ.

3.5 Summary of the Research Procedure

In the previous sections, the individual decisions and associated justifications for the choice of study design are discussed and presented in each case. Underlying epistemological and ontological convictions lead to a philosophical positioning in social constructivism. The approach is inductive, as the codes and categories are identified from the experts' answers. The GDM is chosen as the method. Since the data in each of the two Delphi rounds is collected from several people at a specific point in time, the design can be described as cross-sectional (Saunders, Lewis and Thornhill, 2019). The method of data collection is an open-ended online questionnaire, which is then analysed in a structured way using the techniques of grounded theory outlined above. In summary, the selected procedure can be seen in its entirety in the following illustration (*Figure 3-1*), which follows the understanding of the method according to Saunders, Lewis and Thornhill (2019).

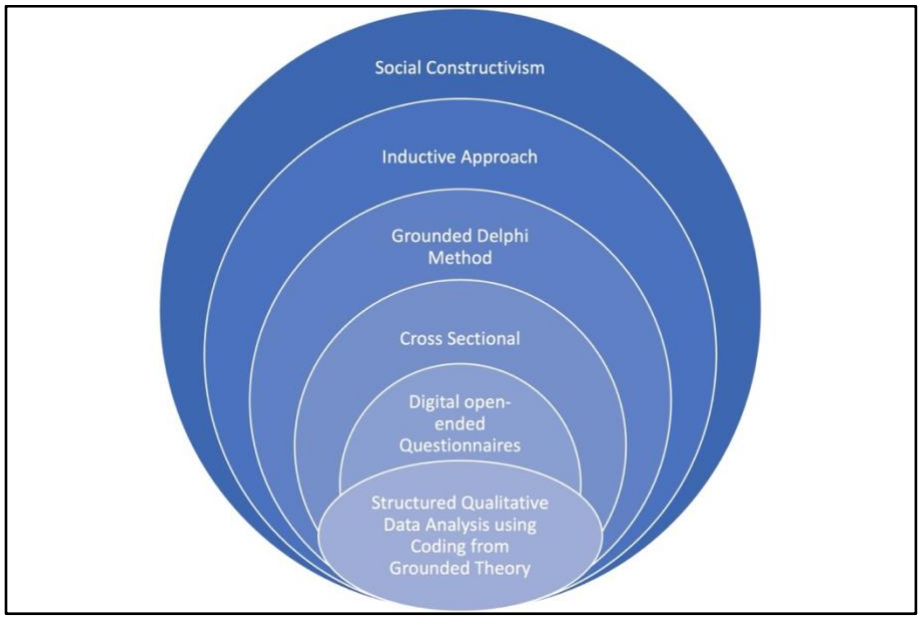

Figure 3-1: Research methodology for this study (adapted from Saunders, Lewis and Thornhill., 2009).

The exact procedure of the GDM is shown for a better overview in the following *Figure 3-2* and illustrates the individual phases from the answering of the first questionnaire by the experts to the data analysis of the first round. Afterwards, the experts receive feedback in the form of the generated statements in Round 2, which they then evaluate and provide with further comments and hints. The comments and evaluation are processed to finally use them in the discussion to answer the RQs.

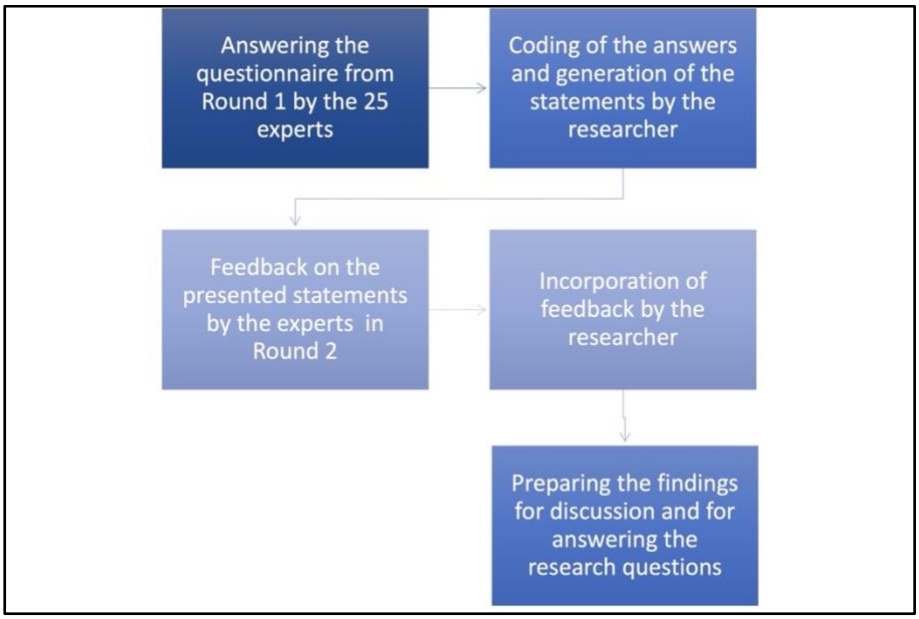

Figure 3-2: Procedure of the Delphi study.

3.6 Role of the Researcher

The chosen study design does not foresee any direct interaction in the data collection frame between the researcher and the experts (neither as a whole nor individually). However, there is a personal level through communication within the study framework and through the fact that the experts and the researcher already know each other. In addition, the qualitative approach is characterised by the fact that the researcher's experience, knowledge, and conviction—despite the structured procedure using the GDM—have an influence on the results, since the researcher cannot be separated from the research process, as is the case with entirely quantitative approaches (Saunders, Lewis and Thornhill, 2019). In addition to the role of an insider researcher, where the researcher is involved and part of the research, there may be other roles that influence the research process and the researcher’s knowledge (Jackson, 2018).

Through the profession, there is already a lot of experience in the field of digital transformation consulting. For this reason, the researcher can influence the experts' findings to the extent of her expertise, which - despite the nature of qualitative research - must be avoided in both data collection and data analysis.

To counteract such influence, great care was taken in the data collection process as well as in the data analysis to prevent bias and distortion by the researcher's own opinions and knowledge. For this reason, the data collection was carried out without direct interaction during the experts' answers to the questions, so as not to influence the experts in this situation - consciously or unconsciously - by the researcher's reactions or statements. The principle was consistently continued in the data analysis. To ensure during the analysis that there is no bias from the researcher's own knowledge or opinions, which are based on her own experience and self-generated knowledge from her professional practice as a consultant, the coding method of Grounded Theory was applied. With the open coding, line by line and within a question and not in the overall context of an expert questionnaire, it was ensured that the co-construction of knowledge only happened based on the data. Thus, to avoid as far as possible any connections to the context of the respective expert in the analysis of the data, the alphanumeric code for the designation of an expert was only noted for the later referencing of the statements and was not considered in the coding process. This enabled the researcher to separate her own experience and knowledge in the context of digital transformation and the question of advancing future key competencies from the analysis process in the best possible way. The focus was on letting the data speak and using the socially constructed knowledge of the experts within the GDM to create new knowledge to answer the underlying research question.

Besides avoiding bias by the researcher, the most important thing is that the research does not harm anyone, neither on a personal nor on a professional level. The ethical considerations are therefore outlined in Section 3.8 to provide a framework for this research against the background of ethical principles. To reflect the fact that the researcher has little experience and that this is the first qualitative study she has conducted, the subsequent section comments on maintaining quality and rigour for this study.

3.7 Quality and Rigour of the Research

In the context of a research project, the quality of a study should be critically reflected. As far as quality criteria are concerned, the standards for quantitative and qualitative designs differ. The nature of quantitative methods is that reliability, for

example, is defined in a specific and measurable way. This seems to be in contrast to the nature of qualitative studies, which is therefore discussed and perceived differently in the literature (Golafshani, 2003; Miller, 2008). Here, the view is followed that even in a qualitative design, quality can be checked according to certain standards. ***Reliability***, generally understood in the context of research as 'consistency and/or repeatability of data collection, interpretation and/or analysis of a project' (Miller, 2008, p. 753), can be demonstrated and tested by several indicators. The first is the ***transparency*** of the research process, to incorporate reliability (Moravcsik, 2014; Hammerschmid, 2020). Within this research project, a stringent process was therefore followed to generate the data and analyse the results, to ensure transparency in every phase of the process (Hiles, 2008). For this reason, the analysis is presented separately in detail in Chapter 4. In addition to reliability, transparency also makes it possible to achieve ***confirmability*** of the results (Jensen, 2008a). Confirmability can also be achieved by having selected participants 'review part of the coding and meaning-making process' (Jensen, 2008a, p. 113), in addition to accurate documentation and citing examples of the coding process. In the method conducted, the GDM, the second round is a possibility to have the meanings inferred by the researcher checked by the experts. This approach also strengthened the ***credibility*** of the study. Credibility was also enhanced by the fact that contact with participants was designed to give them a chance to grasp the context of the study (Jensen, 2008b). As the researcher's and participants' mother tongue is German, the contact with the participants, information on the questionnaires and study as a whole were conducted entirely in German, which should avoid misunderstandings due to linguistic imbalance in a foreign language. According to the researcher, the linguistic nuances, idioms and depth of content of the results are better guaranteed this way. The ***translation*** for the incorporation of the results into the thesis will only occur in the form of the generated codes and categories respectively in the form of quotations translated by the researcher in the context of the findings presentation. For these translations, software is additionally used to incorporate the meaning of the German statements into the thesis in the same form in English.

A good quality research process also contributes to the rigour of the research (Saumure and Given, 2008). In general, the characteristics just described, such as transparency, credibility, reliability, can constitute the rigour of a qualitative study

(Saumure and Given, 2008). With specific reference to Delphi studies, Brady (2015, p. 4) states, ‘In Delphi studies, the main rigour control is the ability of participants to expand and revise the data as the study progresses, and the use of consensus in determining which responses and data are valid’. For the present study, the chosen method of data analysis of the qualitative data in Round 1—coding according to grounded theory—also contributes to more rigour. The structured coding process, described in detail in Section 4.2, considers the basic idea of Glaser and Strauss (1967), whose original idea of grounded theory techniques was ‘to apply the logic and rigour of quantitative studies to qualitative data’ (Hammerschmid, 2020, p. 71).

3.8 Ethical Considerations

In the context of this qualitative research project, data is collected from people. Ethical considerations have therefore already been mentioned at some points in the thesis. The purpose of this chapter is to outline the ethical issues involved in this work and to ensure that the research is conducted in accordance with the university's ethical principles. General ethical principles apply to this research, based primarily on the dignity of the individual, whether as participant, researcher or reader (Anastas, 2004; Bryman and Bell, 2007). The responsibility for protecting participants and upholding ethical principles rests with the researcher (Creswell and Creswell, 2018). The protection of the participants (here experts) must be ensured under various aspects. This begins with the acquisition of the participants and the entire process of information and consent to participation and extends to the collection and subsequent evaluation and presentation of the data. These aspects that must be covered are outlined below.

Sub-section 3.4.1.3 describes how experts should be recruited from the researcher’s personal network. This leads to the need to pay special attention to ensuring that the researcher does not get into conflicts of interest, especially with regard to later published results (Brymann and Bell, 2007). Power relations between the researcher, the experts and the context of the research must also the considered. Participation must be based on absolute voluntariness so as not to create any pressure or sense of obligation on the part of the researcher for a potential participant (Brymann and Bell, 2007). When participating, experts must be confident that only data needed for the research is collected and that no other information is obtained from participants that is

not related to this project (Gibbs et al., 2007). To maintain confidentiality and anonymity, it must not be possible to draw conclusions about the identity of the participants from the results (Anastas, 2004). To preserve confidentiality for the participating experts, the researcher undertakes that the participants cannot be identified (either directly or indirectly) and that at no time will their identities be disclosed to third parties. This is achieved by assigning an alphanumeric participant code to each participant (expert) for maintaining anonymity, which does not allow any conclusions to be drawn about the person, as all identifiers are removed. To refer to individual statements, this code is used in the thesis. The assignment of the codes to the individual experts is treated with appropriate confidentiality.

Ensuring ethical principles also implies that the experts are informed in advance about the purpose of the research, the procedure, the right to withdraw, as well as the process of data collection, analysis and the remainder of the data before, during and after the study, to decide on participation on the basis of as complete information as possible (Brymann and Bell, 2007). To this end, the ***participant information sheet (PIS)*** attached in Appendix 3.3 was sent to potential participants after the initial contact, briefly outlining the study, to those who expressed interest in participating. In addition to the PIS, potential experts are offered the opportunity to clarify questions or further information at any time in a direct telephone call or via e-mail to create a transparent basis for decision-making. Contact details from the researcher as well as the supervisory team and the Secretary of Research Ethics Panel for College of Business, Psychology and Sport, to speak to an independent person are listed in the information sheet for that purpose. Within the PIS, the potential participants are provided with detailed information about the study, the purpose, the procedure and, above all, the use of the data, the confidentiality and anonymity to which the researcher has committed herself, the voluntary nature of participation and the possibility of withdrawing at any time. If the experts are interested in participating, they are sent a declaration of consent, which must be signed by the experts to confirm their participation after a thorough review and examination. This consent form can also be found in the Appendix 3.4. Of course, even after the experts have given their consent, they still have the right to withdraw from participation. A withdrawal can be made up to 10 working days after the data collection. Once the evaluations of a collection round have been completed, an expert may

withdraw for future rounds. Data supplied up to that point that have been processed in the group assessment cannot be removed at that time, as this could affect the usability of the other data. This information is clearly noted for the participant in the PIS and in the consent form.

With regard to the processing, storage, backup and subsequent destruction of data, the GDPR is used as a guideline. The expert group is questioned with the help of an open questionnaire. The inquiry is conducted online via the platform LimeSurvey, which is a German provider that enables surveys of various kinds via a cloud service. To create a questionnaire, registration as a user is necessary, where the storage location of the survey can be selected, including the data used in it. For this project, the storage of the data on a German server is chosen to comply with the GDPR guidelines to the right extent[2]. The results of the questionnaires are exported from LimeSurvey and stored locally, with appropriate password protection, and processed for analysis in NVivo. For the analysis of Round 1 in NVivo, only the answers and the alphanumeric codes enter the software. All previous data from the first section is not considered there. The answers are analysed on the basis of a single question from the questionnaire and not per participant, so that it can be guaranteed that it is not possible to draw conclusions about individuals from the data. After completion of the analyses, the data and the NVivo projects will be stored for a period of 10 years in accordance with the university policy on the OneDrive assigned to the researcher via the university. After a successful viva and incorporation of changes, the files and printouts used to produce the thesis are deleted and destroyed by a certified disposal company in accordance with data protection regulations. Temporary files are also deleted from the storage media. After the 10-year period has expired, the submitted data will be safely disposed of in accordance with university regulations (e.g. by cross-cut shredding or incineration).

In addition to adhering to the processes described, a high level of sensitivity on the part of the researcher is required at all times. The experts are asked to share personal perceptions, the personal implications of which cannot be assessed by the researcher. Thus, very sensitive topics can be the subject of the study. Reflexivity, sensitivity and respect play a fundamental role in the research project, as in qualitative research in

[2] https://www.limesurvey.org/support/faq/39-data-protection-and-policy.

general, at every stage of the process (von Unger, 2016).

3.9 Chapter Summary

This chapter has set the methodological framework for the thesis. For this purpose, the philosophical positioning of the study was presented and justified after a contextualisation of the study. Following this, the chosen research strategy was derived, presented and critically discussed in detail to describe the specific procedure in the form of the GDM. The participating experts and their specifications were shown. Subsequently, the first round of the Delphi survey was described from preliminary considerations, the design of the questionnaire to the procedure. The implementation of Round 2 is described in the following chapter, thus within this chapter the research procedure was summarised to then go into detail on how to ensure the quality and rigour of the study. Finally, a great emphasis was placed on the ethical considerations, and they were addressed in a detailed analysis. In Chapter 4, the data analysis procedure and the development of the questionnaire for the second round are presented.

4. Procedures of Data Analysis and Round 2 Questionnaire Development

4.1 Introduction

This chapter describes the application of the GDM in this research study. Section 4.2 presents the qualitative data analysis of the responses from the first round of the Delphi survey. The purpose of the first round of the Delphi study was to obtain extensive data from the expert panel using the questionnaire presented in Sub-section 3.4.2.2 to serve as a foundation for formulating the statements for the second round of questionnaires. The criteria that characterise the expert panel are outlined in Sub-section 3.4.1, and the composition of this expert panel is presented in Sub-section 3.4.1.3. Information on the participating experts is presented in the following sub-section with regard to the response rate and the affiliation to the different perspectives that stem from the conceptual framework. Further details on the background of the experts can be found in the analysis of the corresponding questions in Sub-section 5.2.1.

In the following section, the entire process of the second round of the study is presented. The second round pursues the goal of having the generated statements assessed by the experts as applicable or not applicable (with various gradations) and to bring further understanding and more depth to the results in the form of further comments by the experts. First, Sub-section 4.3.1 shows the development process of the questionnaire for the second round, which is based on the findings from the data of Round 1. This is followed by a description of the analysis process of the second round in Sub-section 4.3.2 and a reflection on it in Sub-section 4.3.3. Section 4.4 concludes the implementation of the GDM by briefly outlining the exact application for this study, before Section 4.5 summarises the fourth chapter on analysis procedures and the development of the survey instrument for Round 2.

4.2 Round 1

4.2.1 Analysis Procedure for Round 1 Questionnaire

The purpose of this first round of analysis was to collect rich qualitative data from the expert panel using the open-ended online questionnaire. The questionnaire was

used in the same form for all participants in the expert panel, with no differentiation according to the perspective represented or other criteria. All questions in the questionnaire were mandatory. Strictly speaking, this function could have been bypassed in the survey software by entering a single character. However, the experts did not use this; the answers were comprehensive and formulated.

The first round of data collection for this Delphi study occurred from 24 October to 7 November 2021. Three of the experts requested an extension of three days. This extension was granted because it did not affect the response to the questionnaire, and the analysis of the data began after all questionnaires were received. All the 25 experts completed the questionnaire in full, so a 100% response rate was achieved.

Table 4-1: Participants—Delphi Round 1.

Perspective from the conceptual framework	Total signed consent forms	Total participants Round 1	Response rate perspective Round 1
Human	5	5	100%
Endogenous	5	5	100%
Exogenous	5	5	100%
Process	5	5	100%
Digital Technologies	5	5	100%
Total	**25**	**25**	
Response Rate	**100%**	**100%**	

The first section of the questionnaire was aimed at demographic information and assessments of the respondent's own experience in the context of the subject. This section was the only one analysed separately and in a different manner. At this point, the answers were recorded to track the average professional experience in years for the entire panel, as well as the age range and respective comments on activity and experience in the context of digital transformation.

The other four sections of the questionnaire were completely analysed in the manner described in Sub-section 3.3.2.2, using elements of grounded theory. The data was analysed in the researcher's mother tongue to achieve depth of content in the analysis and to avoid possible translation inaccuracies—especially with regard to the wording for the second round.

In the first step of the analysis, the answers were downloaded and saved as a Word document using the LimeSurvey export function. For each expert, a Word document was created containing all answers for the entire questionnaire. In total, the experts' answers comprised about 23,000 words. Since the answers per participant were reported in one document, the researcher transferred all answers into one Word file per question in the first step of the analysis, since the evaluation occurred on the basis of one question, not one participating expert. *NVivo for Mac version 1.6.1* was used for the qualitative processing of the data. Word documents with the answers based on each question were imported into NVivo and edited in an NVivo project.

4.2.1.1 Open Coding

Open coding is the first step in systematic evaluation of the responses from Round 1 and was done question by question. For this purpose, the researcher went through each line of answers step by step within the file of a single question and assigned individual words, partial sentences, whole sentences or smaller sections in NVivo by means of a code (referred to as 'nodes' in NVivo). The so-called in vivo coding has also been used in individual cases, such as for clear terms such as 'artificial intelligence'. Even in this first coding round, several parts of answers resulted in individual codes for a question, some of which were also applied several times in further questions.

The procedure is illustrated using the example of the code **'automation'**.

Parts of the responses from individual experts to Question S21a, 'How do you generally assess the development of digital technologies in the next 5 years? Please describe a possible future scenario for you' were assigned the code **'automation'**. The code was used for a total of seven individual references, which were assigned to the statements by six experts. The following original statements were coded with the code 'automation' for Question 21a:

Expert *13MExS*: *'Automated activities will become more common… [and] robotics and co-botics will gain importance on a broad scale to also perform manual and industrial (manufacturing) tasks.'*

Expert *2MEnW:* *'Work that is still done in analogue today, but can be automated just as well and probably even better, will also be digitised.'*

Expert *6NEnL*: *'For any tasks that can be systematically described, the degree of automation of the activities will increase in the first step and then become (almost) fully automated in the second step. This will have an impact on all occupational fields, as corresponding digitalisation/automation potentials can be found everywhere—sometimes more, sometimes less, sometimes sooner, sometimes later.'*

Expert *9NHuT*: '*The technology will gradually replace repetitive processes completely.'*

Expert *22MHuK*: *'Otherwise, it will be exciting to see how good automation really becomes and how much more difficult but automatable tasks (such as programming) are taken over by technology.'*

Expert *24NHuM*: *'Automation will continue to advance in all sectors.'*

This process identified a total of 700 different codes across all questions. Some codes were used in multiple questions, such as the code 'automation', which was used in five of the questions, for a total of 26 responses.

Table 4-2 below shows the sum of the codes per question and the number of all references per question. It should be noted that some codes were used in several questions and sections. As such, the sum of the codes from the table does not equal the total number of 700 individual codes shown.

Table 4-2: Coding quantity—Open coding.

Question	Open Coding	References
S21a	61	120
S21b	48	84
S21c	62	91
S21d	55	65
S21e	33	41
Sum Section 2.1	259	401

S22a	53	83
S22b	54	68
S22c	59	82
S22d	62	67
S22e	39	45
S22f	30	40
S22g	18	32
Sum Section 2.2	315	417
S3a	93	110
S3b	68	74
Sum Section 3	161	184
S4a	58	64
S4b	26	29
S4c	48	48
S4d	41	44
S4e	15	31
Sum Section 4	188	216

As part of the stringent procedure of open coding, memos and definitions for codes were used repeatedly during the process to check that the understanding of a given code remained valid, even if it was applied several times in the context of different questions. The use of memos serves as a reflective record of the ideas that arise in the course of coding to the codes so that they are not forgotten above the evaluation (Glaser, 1992; Groenewald, 2008). The memoing was also applied to the categories that were later formed from the codes in the axial coding step. In this analysis, the use of codes and categories was particularly helpful to the researcher in maintaining the boundaries between the codes and categories, as the aspects are closely interrelated. For example, for the code ‘human’, the memo ‘aspects that relate to the individual and the challenges they face’ was used and is thus well distinguished from the code ‘new way of working’, which was defined by the memo ‘describes what will be characteristic of the changes brought about by new digital technologies in terms of ways of working’ for the coding process. The open-coding phase and the resulting

codes form the basis for the next coding stage—axial coding—which is presented below.

4.2.1.2 Axial Coding

For the axial coding, individual questions are still evaluated one after the other at the beginning. For this purpose, a new NVivo project was created for each question, and the respective file with the question and the associated codes was imported into the new project. The researcher decided on this procedure to identify categories within a single question in a clear and structured manner.

For the formation of categories, the researcher went through the codes from the open coding again to identify the affiliation in possible categories. In some cases—such as the example of the code ‘automation’ given above—the original code was retained as a category. In most cases, however, several codes could be grouped into categories. The following example of the category **‘use of modern digital technologies’** illustrates the procedure. *Table 4-3* shows the category and the assigned codes. In total, 36 references were assigned to the category; the distribution amongst the individual associated codes is also shown in the table.

Table 4-3: Categories and assigned codes—Example: Axial coding.

Use of Modern Digital Technologies	**36**
3 D print	1
Autonomous driving	1
Big Data	5
Cloud	6
Digital integration	3
Digital twin (complex products)	1
E-mobility	1
Artificial intelligence	6
Managed services	1
Modern assistance systems	1

Quantum computing	2
Security	1
System provider	2
Telemedicine	1
Virtual and augmented reality	2
Increasing networking	2

This procedure was applied on the basis of each question and resulted in the number of categories per question as shown in *Table 4-4*. It should be noted that some categories were used in various sections and questions.

Table 4-4: Number of categories and codes per question after axial coding.

Question	Open Coding	Axial Coding
S21a	61	8
S21b	48	5
S21c	62	4
S21d	55	6
S21e	33	6
Sum Section 2.1	259	24
S22a	53	5
S22b	54	5
S22c	59	5
S22d	62	5
S22e	39	5
S22f	30	5
S22g	18	6
Sum Section 2.2	315	27
S3a	93	19
S3b	68	17
Sum Section 3	161	-/-
S4a	58	9
S4b	26	12

S4c	48	10
S4d	41	8
S4e	15	4
Sum Section 4	188	30

After the initial consideration of using these categories per question as a basis for the statements of the question catalogue of the second round, this was abandoned due to the meaningfulness of the contents. Instead, the categories of all the questions in a section were combined again into categories in the next step. This identification of the core categories thus represents the step of selective coding.

4.2.1.3 Selective Coding

The last coding step, selective coding, uses the previously formed categories from axial coding. Different approaches were chosen for the four sections. Sections 2.1 and 2.2 were selectively coded within the entire section. Section 3 remains in the structure of the original questions and is based on the categories of axial coding for the later formulation of the statements. The same procedure is also used for Section 4, as the questions in this section contain different aspects and mixing them makes no sense in terms of content.

For the selective coding of Sections 2.1 and 2.2, the researcher again created a new NVivo project for each section of the questionnaire and imported the individual projects from the axial coding whose questions belong to the section. To create the main categories, the existing categories were first reviewed and annotated to make a possible assignment to main categories. This assignment was checked for plausibility by rereading the corresponding text passages from the experts' answers and the corresponding codes from the open coding phase to make a final decision on the assignment to main categories.

The procedure for the main category 'new type of cooperation' from Section 2.1 is shown as an example. Axial coding categories were assigned to this main category. The assigned categories **'way of working'**, '**impact on teams'**, '**characteristics of new collaboration'** and '**digital collaboration'** are provided with a description and the number of individual references as well as the number of questions in which they

appeared in the coded responses are also shown in *Table 4-5* below.

Table 4-5: Example of main category—Selective coding.

Category name	Description	Questions	References
A NEW KIND OF COOPERATION		5	96
Mode of operation	Describes what will be characteristic of the changes brought about by new digital technologies in terms of ways of working	3	30
Impact on teams	Aspects of leadership and interaction	1	24
Characteristics of the new cooperation	How can the cooperation be described, what effects can be expected in general?	1	31
Digital collaboration	Increasing flexibility and change through the use of digital technologies	1	11

This step of selective coding resulted in the number of main categories per section listed below in *Table 4-6*, which serve as the basis for the subsequent formulation of statements for the second round of the Delphi study.

Table 4-6: Overview quantity of main categories and categories—Selective coding.

Question	Axial Coding	Selective Coding
S21a	8	
S21b	5	
S21c	4	
S21d	6	
S21e	6	

Sum Section 2.1	24	6
S22a	5	
S22b	5	
S22c	5	
S22d	5	
S22e	5	
S22f	5	
S22g	6	
Sum Section 2.2	27	6
S3a	19	
S3b	17	
Sum Section 3	-/-	2
S4a	9	
S4b	12	
S4c	10	
S4d	8	
S4e	4	
Sum Section 4	30	4

The main categories formed are the basis for the formulation of the statements for the second round of questioning in the Delphi study. This process is explained in detail in Sub-section 4.3.1.

4.2.2 Brief Reflection of the Analysis of Round 1

The procedure chosen for the data analysis of Round 1 of the Delphi study made a structured approach possible, through which the large number of responses could be systematically processed.

The use of the memo function within NVivo helped to maintain and ensure the meaning of the coding in the data. A printout of the codes for each question was used to summarise the data into categories, as it was helpful to make analogous notes and connections. It turned out that the memos made were not shown in the report. In the subsequent course, descriptions for codes and categories were, therefore, used wherever necessary, as these were also shown in a printed report. This further improved the clarity of the analysis.

As a further function, starting with axial coding, cases were also used. The case ‘person’, for example, contains four attributes:

- Age (indicated in the requested age range from the questionnaire),
- Work experience (expressed as a decimal number),
- Gender (male / female), and
- Perspective (endogenous/exogenous/digital technologies/process/human)

Differentiation in cases and consideration of the results with regard to attributes was not necessary for the first round of analysis, since it was exclusively about the overall group results and not about an interpretation according to different characteristics. However, the possibility to analyse the data against the background of cases and individual characteristics is interesting for later considerations regarding the advancement of the identified future key competencies in GM.

4.3 Round 2

4.3.1 Development of Round 2 Questionnaire

4.3.1.1 Design of the Data Collection Instrument

In the second round of the Delphi study, the expert panel answered another questionnaire. The basis for this questionnaire was exclusively the evaluated data from the first round. The aim was to have the experts evaluate the results of the first round and to enrich them with further comments. This serves as a basis for the discussion of the results with the existing literature and thus creates a basis for answering the RQs. The data, which were divided into main categories within a section in Round 1, served as the basis for formulating the statements per section for the questionnaire of the second round of the survey.

As already described in sub-chapter 4.2.1.3, the main categories from the selective coding were used to formulate the statements in sections 2.1 and 2.2 of the questionnaire. Thus, in section 2.1 of the first round questionnaire, a total of 402 codes were formed (open coding), which were analysed into 24 categories (axial coding) and

then into six main categories (selective coding). In order not to lose the meaning of the expert answers or to avoid statements that were too abstract or undifferentiated, the text passages from the expert answers and the corresponding codes from the open coding phase from the six main categories were read again for the formulation of the statements and used for the statement formulation. Accordingly, going back to the answers and the coded text passages formed the basis of meaning for the formulation of the statements. This resulted in a total of 28 statements for section 2.1 of the questionnaire. The same procedure was followed for section 2.2 of the questionnaire, resulting in a total of 417 codes (open coding), 27 categories (axial coding), six main categories (selective coding) and finally 51 statements.

Since some expert statements refer to future developments, the temporal component—i.e., the time span to which the statement refers, such as 5 or 15 years—was considered when formulating the statements. The formulation of the statements was guided by the criteria for the formulation of questionnaires and, in particular, by the following requirements (Höpflinger, n.d.; Lederer, 2022):

- Not too general;
- Comprehensible;
- Neutral formulations;
- Clear assessment possible; and
- One essential aspect per statement, not several

Another requirement was to consider as many of the aspects of the first round of questioning as possible in the form of statements. Conversely, it was important to ensure that the total length of the questionnaire could be answered completely by the experts in a reasonable amount of time and effort (Brosi et al., 1999). The number of statements was more extensive than that assumed at the beginning. However, after intensive examination of the results, a further reduction of the content was not reasonable, as this would lead to aspects of the expert answers being omitted. The researcher believed that experts could cope well with the number of statements. On the

one hand, this was to be expected since they themselves contributed to the basic content of the statements. On the other hand, their expert status makes them knowledgeable and involved in the topic, so it could be assumed that they can quickly grasp the content of the statements and then evaluate them themselves. Furthermore, with the LimeSurvey software, it is possible to pause the processing of the questionnaire and continue at a later time, which is a considerable difference from other common surveys.

The main categories that emerged as a result of the analysis in Round 1 were used as a basis for formulating the statements. The following example shows the procedure for the category **'technology'** from the first section of the questionnaire (Section 2.1 of the first-round questionnaire):

Table 4-7 presents the main category **'technology'** for the entire Section 1, including the categories assigned from the axial coding of the individual questions that were assigned to this main category. For simplicity, the individual codes within the categories are not shown. A complete list can be found in Appendix 4.1. For the formulation of the statements, the researcher consulted not only the categories but also the underlying codes and the corresponding original statements of the experts.

Table 4-7: Example—Main category 'Technology'.

2	TECHNOLOGY
	Automation
	Use of modern digital technologies
	Technologies
	Technological aspects
	Technological effects
	Technological drivers

2 TECHNOLOGY
Growth in the use of digital technology

The first draft of formulations was handwritten and refined with constant feedback on the data until the final statement was recorded in a file. The number of statements were guided by the different aspects mentioned within the underlying answers in the main categories. In this example, the following four statements were formulated for the category **'technology'**:

- Digital technologies will continue to be increasingly integrated into all sectors over the next 5–15 years, thereby gaining greater prominence and penetration.
- Through digital technologies, the degree of automation will continue to increase, and analogue activities and process steps will be replaced.
- This development leads to more transparency, efficiency and to leaner, interlinked processes.
- In the upcoming years, the main technological drivers will be artificial intelligence, augmented and virtual reality, cloud computing, Big Data and data analytics.

This process was conducted to generate all statements from Sections 1, 2 and 4. Section 3—which deals with future competencies—was formulated with the aim of naming competencies and accordingly consists of a list of the competencies identified in the first round. To make the questionnaire clear, a structure with corresponding numbering of the statements was created, which is explained in the next section.

4.3.1.2 Structure of the Questionnaire

The structure of the questionnaire for Round 2 was based on the questionnaire from Round 1. Section 1 of the first round was used to classify expert status and to provide demographic information and is therefore not considered further for Round 2.

The other sections were taken over, but, for the sake of clarity, the numbering of the sections was adjusted, as shown in *Table 4-8*. The numbering of sections was also changed.

Table 4-8: Overview questionnaire sections Round 1 and corresponding sections Round 2.

Questionnaire Round 1	Questionnaire Round 2
Section 1: Demographics of the expert panel	No component in the second round
Section 2.1: Digital Transformation—General Assessment	**Section 1:** Digital Transformation—General Assessment
Section 2.2: Digital Transformation—German Mittelstand Companies	**Section 2:** Digital Transformation—German Mittelstand Companies
Section 3: The Human in Digital Transformation	**Section 3:** The Human in Digital Transformation
Section 4: Recommendations for Action	**Section 4:** Recommendations for Action

Within the sections, the statements are divided into categories. These categories are those that emerged from the selective coding in Round 1. The structural design of the questionnaire, including the number of statements, can be found in *Table 4-9*.

Table 4-9: Structure of questionnaire—Delphi Round 2.

Section 1: **Digital Transformation—General Assessment**	
Category 1 ‘Technology’	4
Category 2 ‘Human and collaboration’	9
Category 3 ‘Change’	4
Category 4 ‘Enterprise internal’	5

Category 5 ‘Enterprise external’	7
Section 2: **Digital Transformation—German Mittelstand Companies**	
Category 1 ‘Mode of operation’	12
Category 2 ‘Humans’	12
Category 3 ‘Enterprise internal’	14
Category 4 ‘Enterprise external’	13
Section 3: **The Human in Digital Transformation**	
Category 1 ‘Essential key competencies’	19
Category 2 ‘Competencies that promise excellence’	17
Section 4: **Recommendations for Action**	
Category 1 ‘Obstacles’	15
Category 2 ‘Measures and prerequisites’	13
Category 3 ‘Individual contribution’	7
Category 4 ‘Most fundamental competency’	15

The complete list of statements can be found in *Appendix 4.4*. For a better overview, the individual statements have been given a code that begins with an ‘S’ for the statement, contains the section number, the category number, and a consecutive statement number. The 7th statement from Category 4, ‘**enterprise external**’, from Section 2 thus has the code ***S-2.4.7***.

To meet the requirement to elicit feedback from the experts in the second round as well, if desired by an expert, each category concluded with an open-ended question, but this was not compulsory. The wording is the same for all categories, as follows:

‘If you have thoughts or comments on one or more statements in the previous category **“technology”**, you can leave them here. Please refer to the relevant statement number(s) (e.g., ***S-1.3.8***).’

At the end of the questionnaire, another field could be used for comments and thoughts from the experts, but did not have to be.

4.3.1.3 Pilot of Round 2 Questionnaire

Despite the systematic and clear approach to the questionnaire and the formulation of the statements, the researcher could not achieve an objective view for the final quality assurance of the questionnaire (Avella, 2016). As such, external support from two colleagues was also obtained for this round to verify the clarity and unambiguity of the statements. In parallel, this pilot test provided the opportunity to check the functionality of the LimeSurvey for this questionnaire and also obtain feedback on it. The feedback from colleagues was regarding typing errors and the use of an ‘and’ in three questions, which would not have made a rating on the scale unambiguously possible. In addition, three of the competencies were felt to be ambiguous, so an explanatory note was recommended. Feedback from the pilot testers was incorporated and the final version of the questionnaire was created in LimeSurvey.

4.3.1.4 Setting the Level of Consensus and Scaling of the Answers

The aim of the second round of this Delphi study was to have experts rate the agreement and disagreement of the statements to identify which aspects should be considered for discussion and outcome development. As a result, some statements may not receive enough agreement to be considered further. For sufficient agreement, a consensus level is set in Delphi studies to determine exactly which statements are accepted and which are rejected. A consensus level can be set in different ways, e.g. subjectively by the researcher, by a predefined number of rounds, by descriptive statistics or by a previously set level of consensus. For a discussion and overview of these, see von der Gracht (2012). A certain level of consensus, as used in political voting, was set at 75% consensus level by Howard (2018). This level was adopted for this study as it allows a clearer indication of the expert panel's opinion than a simple majority of more than 50%.

Several possibilities were conceivable as a basis for determining the level of agreement. Since the perception should be possible for the experts in a more differentiated way and not a simple choice between ‘I agree’ and ‘I disagree’ should be

displayed as options, the researcher decided to use another choice option. The evaluation leans on a 5-point Likert scale, with the response options listed in *Table 4-10*. Multiple responses to one of the statements are excluded.

Table 4-10: Response options — Delphi Round 2.

Fully agree	Rather agree	Neither agree nor disagree	Rather disagree	Do not agree at all

The choice to give such a differentiated selection of answer options was intended to avoid, on the one hand, that an expert often chooses the 'neither' variant when wavering between agreeing and disagreeing, as can be the case in the chosen design of Howard (2015), in the opinion of the researcher. On the other hand, the given options should lead to a more differentiated picture than mere "yes/no" options.

In line with the qualitative approach of this work, the choices do not claim to provide a measure of the distances between them and assume equality of distances. The choices merely serve to map frequency but do not allow—and do not intend—to rank the individual statements on this basis (Lawal, 2003; Marateb et al., 2014). It is considered that the selected response options represent a 'discrete-ordinate scale' as a 'nominal variable' (Marateb et al., 2014, p. 48), or in other words, reflect the degree of expression, to inquire—as in this case—about the experts' attitudes towards the statement presented (Lawal, 2003; Marateb et al., 2014). Statistical operations are not possible for this, so they are not applied here and are not necessary for the purpose of the evaluation. As such, the answers do not have a numerical value. The count of 'agree' responses ('fully agree' and 'somewhat agree') was used to determine the level of consensus. If more than 75% of the experts selected these two answers for a statement, a consensus of 75% was reached, and the statement was accepted. Statements that achieve more than 75% consensus are considered later in the discussion of results. A certain number of statements or a ranking of the statements is not a necessary criterion for this thesis and the Delphi study, as the Delphi study primarily serves to provide essential ideas for the present RQ of the study, which are then incorporated accordingly to find answers how to advance the identified future key competencies in German Mittelstand.

4.3.2 Analysis Procedure for Round 2 Questionnaire

4.3.2.1 Procedure of Round 2

For the second round of the study, as in the first round, the 25 experts were contacted by email via the LimeSurvey platform, and the individual access link enabled access to the questionnaire.

The survey occurred from 25 February to 11 March 2022. All 25 experts who had confirmed their willingness to participate in the study, and who had already participated in the first round, received the personal access link via email. None of the experts withdrew their participation. Three of the experts did not react in any way to the notification, one other reported a great lack of time and wanted to 'try' to complete the survey, which unfortunately did not occur. All other 21 experts completed the questionnaire in full, which represents a return rate of 84%, distributed relatively evenly across the five perspectives, as shown in the *Table 4-11* below.

Table 4-11: Participants — Delphi Round 2.

Perspective from the conceptual framework	Total participants Round 1	Total participants Round 2	Response rate perspective Round 2
Human	5	3	60%
Endogenous	5	4	80%
Exogenous	5	4	80%
Process	5	5	100%
Digital Technologies	5	5	100%
Total	**25**	**21**	
Response Rate	**100%**	**84%**	

By using the LimeSurvey platform, all answers for the second round of the questionnaire were saved in the respective project after completion. As such, the results had to be exported again. The LimeSurvey platform offers several possibilities to export and evaluate the answers. The evaluation is described in detail in the following sub-section.

4.3.2.2 Analysis Instrument and Evaluation

Unlike in the first round of the study, the answers in the second round were mainly about the evaluation of the perception of the individual statements with the options described in the previous section. An export of the overall report of the questionnaire is divided into the individual statements. For each statement, it is shown

how many participants chose a certain answer option in each case. In addition, behind the number per answer option, the percentage of the entire expert panel that opted for the respective answer for the individual question is also listed. An example from the report for statement ***S-1.1.4*** can be found in Appendix 4.5. For the evaluation of the results, only the answers 'fully agree' and 'tend to agree' were considered. The corresponding percentages are listed in the findings after each statement. For this presentation on the basis of the individual statements, the researcher created a list in Excel, which, in addition to the degree of agreement in percent, also has a graphic element to directly recognise in the presentation which statements were accepted and which were not.

The answers from the free text fields were exported into Microsoft Word documents. Since these responses are purely qualitative data that can be directly attributed to the respective statement by indicating the statement number, the notes and comments on a particular statement were considered together. Due to the relatively small number of commentaries per statement, a dedicated coding process for this step of the evaluation was not necessary. Instead, the procedure used was that if the meaning of the statement was the same or very similar, the comments were paraphrased. Where the content within the annotations differed, the individual facets were presented as direct quotations or worded accordingly in the findings chapter. This additional information has no influence on the determination of the consensus level and is used for a better understanding of the assessment results and for further content notes from the experts to bring more depth to the collected data.

4.4 Summary of the Applied Grounded Delphi Method

The procedure of the GDM in particular is strongly oriented towards the procedure selected by Howard (2015), but it deviates in the first round with regard to the instrument of data collection. In contrast to Howard (2015), who used focus groups to generate data in the first round, in this research project, data was generated from the experts' responses by means of an open-ended online questionnaire. The analysis was conducted using the described coding steps (open coding, axial coding, and selective coding). Based on the main categories after the complete coding of all data, statements were formulated, which in the second round were again made available to experts for

evaluation via an online questionnaire. At this point, the second deviation of the procedure according to Howard (2015) occurred. Although Howard provided the three assessment options (agree/disagree/partly agree or partly disagree) for experts, the researcher opted for a more differentiated gradation using the response options presented in Sub-section 4.3.1.4. The consensus level was determined on the basis of the percentages of agree answers, as described in the previous section.

In addition to the evaluation of the statements, the experts had the opportunity to voluntarily leave notes and comments on the statements and were not asked to do so after a specific assessment, as in Howard (2015). This should influence the selection of the assessment even less. Furthermore, experts could share their thoughts on the statements independently of their assessment, which added more depth to the results. For data analysis, the researcher used the analysis software NVivo12 to code the large amount of data in a structured way, which was useful in formulating the statements. The results of the second round were analysed in Excel to determine the consensus level. Additionally, the comments on the individual statements were summarised and included in the thesis results presentation to give the results further depth and consider them in the discussion. The chosen procedure has brought to light a large amount of data and strongly substantiated statements to answer the RQ.

The chosen analysis methods were a structured way to process the generated data from the experts' answers. The amount of data from the first round could be well handled and systematically processed through the analysis using open, axial and selective coding to serve as a basis for the formulation of the statements for Round 2, the evaluation of which was possible in a clear and structured way due to the chosen procedure. The option of leaving additional notes and comments by the experts created an opportunity to add further depth to the data. The results of the two Delphi rounds are presented in detail in Chapter 5.

5. Findings of the Grounded Delphi Study

5.1 Introduction

This chapter presents the results of the Delphi study according to the procedure for data collection and analysis presented in the previous chapter. Above all, the process clarifies how the respective statements are built up from the experts' answers from the first round of data collection within the second round and how consensus is reached. The experts' comments within the second round also provide a more profound understanding of the results as a basis for a later discussion of the findings. This paves the way for answering the underlying RQ and ROs.

RQ: How can the identified future key competencies for digital transformation be advanced in German Mittelstand from a SHRM perspective, considering the complex interrelationships and expected developments?

RO1: To create an understanding of digital transformation, the interdependencies of related areas and the effects on organisations in German Mittelstand;

RO2: To investigate the future key competencies resulting from digital transformation in German Mittelstand, using expert knowledge; and

RO3: To provide new insights for advancing the identified future key competencies for digital transformation in German Mittelstand using expert knowledge.

To provide the reader with a good orientation within the presentation of the results, the chapter is divided into two main parts. First, the results of the first round of the questionnaire are presented in Section 5.2, followed by the results of the second round of the Delphi study in Section 5.3. The structure of the sections of the questionnaires is retained. Within the sections, the results are subdivided into the categories that emerged. After the presentation of the results from the two rounds, the findings are summarised in a final section to use as a basis for the subsequent discussion of the results.

5.2 Round 1: Open-ended online Questionnaire

5.2.1 Brief Introduction

The first round of the Delphi study aimed to generate rich qualitative data from the expert panel. For this purpose, the experts completed an open-ended online questionnaire, the structure of which—as in Sub-section 3.4.2.2—was primarily oriented towards the findings from the conceptual framework, to obtain much information on the phenomenon of 'digital transformation' in GM and to create a basis for gaining new insights into how the experts arrive at their perceptions and what they believe needs to be done to successfully advance future key competencies. The qualitative data was analysed using grounded theory coding, which resulted in a total of 700 codes after open coding was completed (see Sub-section 4.2.1.1 for details of this process). The entire coding process and the resulting codes and categories are explained in detail in Sub-section 4.2.1. In the following, the findings regarding the content are presented in detail.

5.2.2 Section 1: Demographics of the Panel of Experts

The first-round questionnaire was made available to the 25 experts who signed the consent form to participate. Of these 25 experts, all completed the questionnaire in full, resulting in a 100% response rate, as shown below in *Table 5-1*. Thus, this response rate ensures the rigour of the first round (Howard, 2015).

Table 5-1: Response rate — Delphi Round 1.

Perspective from the conceptual framework	Total signed consent forms	Total participants Round 1	Response rate perspective Round 1
Human	5	5	100%
Endogenous	5	5	100%
Exogenous	5	5	100%
Process	5	5	100%
Digital Technologies	5	5	100%
Total	**25**	**25**	
Response Rate	**100%**	**100%**	

At the beginning of the first round of the study, experts were asked to provide information about themselves and their professional background. These served to ensure the criteria of an expert for this study, as previously defined in Sub-section 3.4.1.2, and equally to check the researcher's assignment to one of the perspectives.

First, the age of each person was asked by means of an indication in the applicable age range. The distribution in *Figure 5-1* shows that almost half (48%) of the experts are in the age range between 40 and 49. One-third (32%) of the experts are between 30 and 39 years old, followed by 16% between 50 and 59 and, finally, 4% over 60.

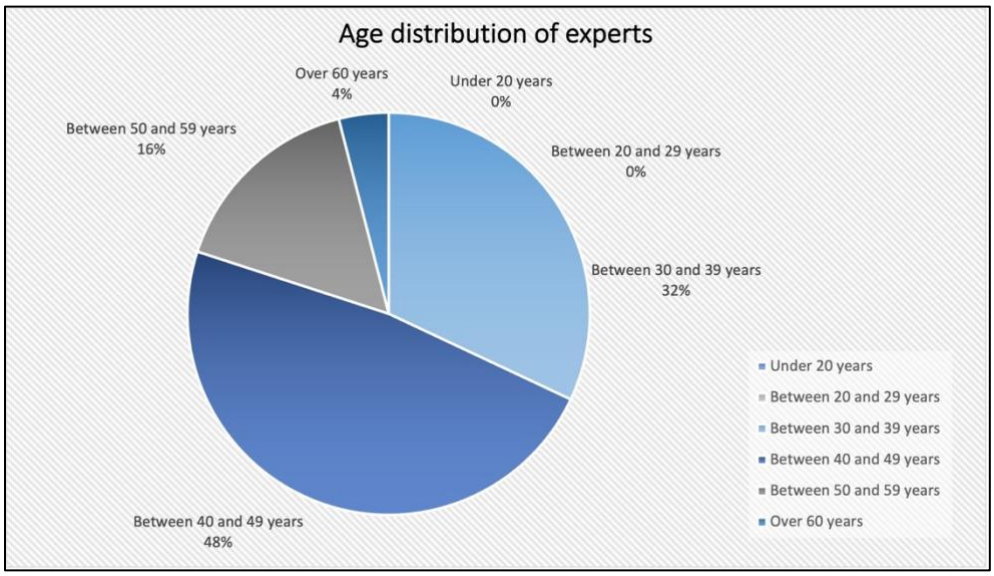

Figure 5-1: Age distribution of experts— Delphi Round 1.

The average length of time an expert has worked in the current position is 9.42 years. The longest period of employment is 33 years in the current position; the shortest 0.5 years. The respective history of professional activity was not queried, so even an expert with a relatively low stated duration in their current position may have had previous experience in a similar field of activity or in the same company and therefore the duration alone is not representative. To further ensure expert status, the experts were also asked to describe and assess their own field of activity against the background of the digital transformation in GM. The affiliation to the Mittelstand sector or the connection to it—previously defined as an exogenous perspective—was in part simply affirmed by the experts or underlined with a description, so that the assignment to the expert group was thus ensured. With regard to expertise in the context of the digital transformation, the following keywords were cited as examples to guide the response:

- Technology;
- Process design;
- Human resource development;
- Strategy; and
- Legal and political expertise.

Feedback showed that the assignment to a specific perspective previously made by the researcher was accurate but at the same time not exclusive. For example, one of the experts made the following statement:

'All the keywords listed in the examples apply to me, but I would particularly emphasise strategy and human resource development. In my view, the latter in particular cannot be separated from technological developments.'

Another expert also highlighted this aspect, by giving the following answer when asked about his expertise:

'Process design, technology, strategy, and human resource development—I think in terms of transformation, the fields have to be looked at holistically—without the human factor, there will be no transformation.'

This underlines the fact that a strict separation of the areas mentioned is not entirely possible in the context of the phenomenon of digital transformation under investigation. For the selection and organisation of the expert panel, the division of perspectives served its purpose to ensure the structured recruitment of the experts and the examination of expert status. The results of this first questionnaire section served the to clarify the quality of the expert panel for the researcher and are not the subject of further investigation. The contents examined are presented in the following sections.

5.2.3 Section 2.1: Digital Transformation—General Assessment

5.2.3.1 Brief Introduction

The results of Section 2.1 of the questionnaire are presented below. This section focuses primarily on the assessments of future developments with regard to technological developments, processes, and cooperation in the next 5–15 years. For this purpose, the following questions were addressed to the experts:

- What is your general assessment of the development of digital technologies in the next five years? Please describe a possible future scenario for you.
- What do you think the processes will look like in five years, in general, due to the development of digital technologies?
- What do you think collaboration will look like in five years in general due to the development of digital technologies?
- What would you add or change in your answers regarding development in the next 15 years?
- What would you add or change in your answers regarding development beyond the next 15 years?

In this first round of data collection, all the questions were answered extensively by all of the experts. As described in Sub-section 4.2.1, the answers to the questions from the first survey round were given codes in several coding steps, guided by the Straussian grounded theory coding procedure (Corbin and Strauss, 1990), and combined into main categories that emerged from the data. *Figure 5-2* shows in the form of a hierarchy diagram (sunburst diagram) the main categories and the associated categories that were developed from the initial codes after the axial coding step.

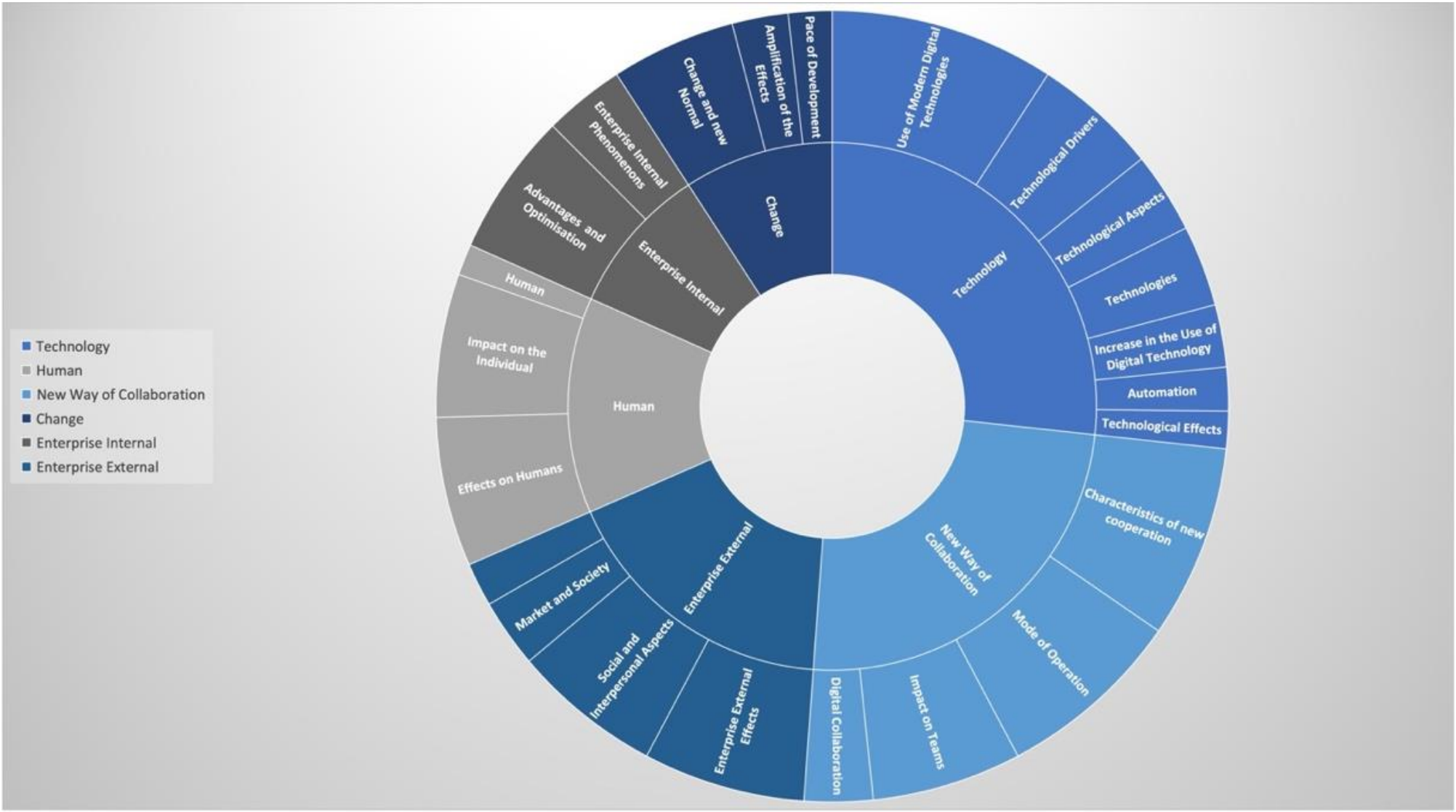

Figure 5-2: Main categories, Section 2.1 'Digital transformation—General assessment' — Delphi Round 1.

The pure number of codes after each of the coding steps has been presented in Sub-section 4.2.1. For the purpose of examining the results, the axial coding categories (shown on the outer ring of *Figure 5-2*) and the resulting main categories (the inner ring of the graph) are the essential part of the results. Although the coding in the open and axial coding steps was conducted on the basis of the individual questions, it became apparent after the completion of the axial coding that in the categories formed there for each question, there was overlap in content with the categories of the other questions. After a content check, and considering the queried temporal components (the next 5 or 15 years), the categories within the section were combined into main categories. In the following, the results for Section 2.1 of the Round 1 questionnaire are presented, guided by these main categories.

5.2.3.2 Category 'Technology'

The category **'technology'** includes a total of 105 codes, which come from the five questions. This main category consists of seven categories. *Figure 5-3* shows the main category with the associated categories and respective number of codes.

Category "Technology"	
Automation	7
Use of Modern Digital Technologies	36
Technology	13
Technological Aspects	13
Technological Effects	6
Technological Drivers	20
Growth in Use of DigitalTechnologies	10

Figure 5-3: Main category 'Technology'—Section 2.1—Delphi Round 1.

Within the main category, all statements were grouped under the above-mentioned categories, based on the codes that the experts named as technological drivers and aspects that will become more prevalent in work processes and collaboration in the future. The effects of the growth in digital technologies are not included; these are considered in the other categories. The category 'technological effects' here also refers to the use of technologies, not their consequences for future cooperation.

Some concrete technologies in particular, such as artificial intelligence, virtual and augmented reality, quantum computing and Big Data, have been explicitly named by the experts. Expert *4SProK*, for example, sees exponential growth in progress and predicts enormous developments, especially in the field of artificial intelligence and quantum computing:

'Advances in technological aspects will increase exponentially in the next five years. Technology will see rapid developments in the areas of artificial intelligence and quantum computing.'

For Expert *6NEnL*, the development is as follows, especially in the area of automation:

'For any tasks that can be systematically described, the degree of automation of the activities will increase in the first step and then become (almost) fully automated in the second step.'

This assessment is also shared by Expert *2MEnW*, who replied, *'What can be automated and digitised will be automated and digitised.'*

Regarding the technological drivers for collaboration, Expert *3PDiTK* predicts that *'digital technologies will provide the platform for this necessary exchange'*.

A similar assessment was shared by Expert *17MDiTR*, who thinks for the future development that an enterprise social network will be of central importance for digital collaboration:

'You are permanently connected to your company through enterprise social networks. In a meaningful way, with gadgets that also simplify your life.'

Expert *8DExS* described the assessment of the development in the area in a comprehensive way with the following statement:

'Digital technologies have become an integral part of all areas of life, and the potential of this has been further developed. Every company will (have to) have points of connection.'

The experts' statements, resulting codes and finally categories within the main category '**technology**' show the forecast that technologies such as artificial intelligence, big data, and machine learning and the resulting automation will be formative in the next 5–15 years. In addition, the component of virtual collaboration through networks and platforms is central for experts.

5.2.3.3 Category 'Human'

The main category **'human'** has a total of 52 codes and is composed of three categories. *Figure 5-4* shows the main category with the assigned categories and the respective number of codes.

Category "Human"	
Effects on the Individual	23
Effects on Humans	24
Humans	5

Figure 5-4: Main category 'Human'—Section 2.1—Delphi Round 1.

In the category **'human'**, all statements were included in the codes mentioned above that experts describe as having an impact on people's work, or in other words, aspects that relate to the individual person and their challenges. Not included are effects on the type of cooperation or effects on an organisation, as these are considered in other categories. In general, it can be seen from the experts' answers that an increasing human-centredness is expected and, above all, that typically human skills will become more important in the course of the changes expected in the future due to the digital transformation. For example, expert *6NEnL* answers,

'On the other hand, I am convinced that the "human" tasks—predominantly tasks with a very high degree of creativity, innovative power, and individual approach—will live more from the personal ability and agility of the people than from classic process descriptions. (Which will be accompanied by) "very high demands on soft skills, self-reflection, self-motivation, and decisiveness paired with high responsibility".'

A change in the requirements for the individual is also supported by Expert *2MEnW* with the following statement: *'The demands on "work" will change.'*

This assessment is also shared by Expert *21HEnH*, who predicted that *'We are challenged to continue learning and redefine what we have already learned.'*

Expert *9NHuT* concretises this change with the prediction that there will be a *'concentration on "qualitative" tasks'*. She sees an increase in the importance of interpersonal interactions: *'At the same time, I firmly believe that it is precisely through this that the importance of interpersonal interaction will grow and be used in a very targeted way (when innovating, brainstorming, etc.).'*

A 'distinctly human-centred' scenario is also outlined by Expert *22MHuK*, who considers it crucial to *'bring in the genuinely human skills in a meaningful and good way'*.

Expert *18TDiTF* predicts that the level of complexity will have an impact on human interaction: *'Due to increasing complexity, human collaboration must increase.'*

The experts outline in their statements, which were assigned to the main category '**human**', that there will be an increase in interpersonal interaction and that with increasing degree of automation the importance of human skills will increase. This is especially true for innovative or creative tasks. To cope with the expected level of increasing complexity, people will have to learn new skills and bring in competencies such as self-reflection or motivation to a greater extent. According to the experts, the activities performed will give way to more qualitative tasks, since repetitive tasks will increasingly be eliminated as activities for people through automation.

5.2.3.4 Category 'New Way of Collaboration'

The main category **'new way of collaboration'** comprises a total of 96 codes and was combined from four categories. *Figure 5-5* shows the main category with the assigned categories and the respective number of codes.

Category "New Way of Collaboration"	
Mode of Operation	30
Impact on Teams	24
Characteristics of New Collaboration	31
Digital collaboration	11

Figure 5-5: Main category 'New way of collaboration'—Section 2.1—Delphi Round 1.

The category 'new way of collaboration' includes all statements under the above-mentioned codes that describe the changes and effects that new digital technologies will have on working methods and collaboration. In addition, statements are included that refer to aspects of leadership or interaction within an organisation or team. The effects on strategic design within the organisation are not included, as these are considered in other categories. The answers of the experts show that increasing agility and flatter hierarchies are expected. Aspects such as place of work and working hours will also become less important, as the fulfilment of the work task no longer ends at the company's boundaries; this phenomenon can already be found at present but will become more pronounced in the future, according to the experts. For example, Expert *11LEnR* describes his assessment of this as follows:

'One scenario that can already be observed is the disappearing boundaries between work and private life due to better networking and flexibility (i.e., not only remote working will then be normal but also the classic working time model will change and can be adapted more flexibly to everyday life).'

This is also supported by Expert *4SProK* with the following forecast of future cooperation: *'It will become hybrid, flexible, and more demanding. Time and space will no longer have the relevance they have today.'*

It is predicted that the importance of regionality will decrease and that working in a digital world will increasingly become the standard (Expert *5JHuJ*). However, according to Expert *21HEnH*, the change is also accompanied by the need to *'constantly adapt ways of working, communicating and living to the circumstances'*.

Another change is seen in the increase in interdisciplinary teams. Expert *18TDiTF*, amongst others, predicts the following:

'Interdisciplinary competence teams will gain in importance in most companies. However, interdisciplinary research will not stop at the borders of a company. In the future, competence teams will increasingly be separated both spatially and organisationally.'

In the context of the **'new way of collaboration'**, the experts emphasise above all the independence of location and time. Additionally, an increase in interdisciplinary teams and a reduction in hierarchies are predicted for the future. However, according to the experts, this will also be accompanied by an increase in the demands on work tasks and a change in manners, which will make it necessary to adapt to the circumstances. The strong need for personal exchange and the corresponding support through events or meeting places is equally predicted.

5.2.3.5 Category 'Change'

The main category **'change'** comprises a total of 36 codes, which are divided into three categories. *Figure 5-6* below shows the main category with the categories assigned and the respective number of codes.

Category "Change"	
Speed of development	7
Change	20
Amplification of effects	9

Figure 5-6: Main category 'Change'—Section 2.1—Delphi Round 1.

The category **'change'** contains coded statements that describe which changes are explicitly described by experts for the coming years and which already mentioned effects of future strengthening are expected. To avoid duplicate of the results, the aspects related to the type of collaboration were excluded here, as they were already considered in the previous category. In the answers that can be assigned to this category after coding, increases in efficiency through expanded technological possibilities are at the core. These also relate to the design of processes and to the place of work and working time, which, for example, no longer requires business trips through virtual collaboration. Experts also expect increased interlinking of processes and organisations in the future (Expert *13MExS*). According to Expert *10EExW*, the following effects, in

particular, will be more noticeable in the future:

'Overall, resources will be able to be planned more efficiently, risks and disruptions anticipated or detected earlier.'

Another central aspect of the answers from this category revolves specifically around Germany as a business location and the changes taking place here. Expert *20BProB* critically notes that *'everything is moving much too slowly in Germany'*, since, according to Expert *5JHuJ*, we are *'only at the very beginning of this development'*. According to Expert *22MHuK*, *'The most relevant changes have not yet really reached the mainstream—which is a massive problem for the German economy. We are very, very much behind in many corners.'* The associated cultural change will also, according to Expert *3PDiTK*, *'take much longer'*.

The different speeds of development—technological and organisational, as well as internal and external to the company—can lead to tensions that need to be managed in the context of change. This is particularly important in light of the fact that experts expect developments to affect all corporate and social areas in the next 5–15 years and that changes will pick up speed.

5.2.3.6 Category 'Enterprise Internal'

The main category **'enterprise internal'** comprises a total of 36 codes and was combined from two categories. *Figure 5-7* shows the main category with the assigned categories and the respective number of codes.

Category "Enterprise Internal"	
Optimisation - Advantages for Enterprises	23
Enterprise Internal Phenomena	13

Figure 5-7: Main category 'Enterprise Internal'—Section 2.1—Delphi Round 1.

The statements of the category **'enterprise internal'** describe which potential advantages for companies regarding the market, product development and cooperation are named by experts. The statements come from different parts of the value chain and predict potential for increasing efficiency in companies. In addition, there are statements

that concern the interaction with the customer. External influences are not included, as these are subsumed under another category in detail. The experts' assessments show that an acceleration of developments is expected by means of data-supported processes and data-driven decision-making (Expert *13MExS*). *Expert 2MEnW* formulates his assessment as follows:

'Digital processes will help us be faster and more effective.'

Expert *16NProK* sees the previously sluggish processes in product development, in particular, becoming much more dynamic in the future, as products then go through the final test at the customer's premises, and demands that *'the new processes must be adapted to the digital realities'*.

Expert *25WProR* also sees the potential for improving processes: *'Automation is the magic word for reducing costs by minimising error potential and saving time.'*

Regarding optimisation potential, many of the experts emphasise that, in addition to automation, the increase in information from data will bring insights in terms of optimisation opportunities (Experts *9NHuT, 23SHuS, 10EExW*). In addition, the experts predict the emergence of new (digital) business models through the increase in technological possibilities.

5.2.3.7 Category 'Enterprise External'

The last of the main categories, **'enterprise external'**, has a total of 68 codes and has been combined from four categories. *Figure 5-8* shows the main category with the assigned categories and the respective number of codes.

Category "Enterprise External"	
Social and interpersonal aspects	24
Market and society	11
Environment and ethics	7
Enterprise Externalities	26

Figure 5-8: Main category 'Enterprise External'—Section 2.1—Delphi Round 1.

Statements concerning effects and challenges on the market and consumer behavior fall into this category **'enterprise external'**. Furthermore, aspects of social issues are also included, which, for example, raise or address morals and ethics in an increasingly automated society. In addition, statements on political and legal aspects are included in the category, which also include security risks or the development of the labour market, amongst other factors. Excluded from consideration in this category are the contents of the other categories already presented above, to draw a line in the consideration on the internal company side and the external side. Within the answers, numerous aspects are mentioned, especially for a scenario after the next five years, which the experts believe need to be adapted or considered. For example, as expressed by Expert *19BExL*, *'The political and legal framework must be advanced. It is also important to digitise municipal and administrative processes, but progress is slow here because existing systems do not usually challenge themselves.'* This aspect is supplemented further: *'The danger of misuse of the accumulation of information and possible manipulation will increase In addition to the political component, the criminal component must also be considered.'*

In addition to the political-legal framework, Expert *2MEnW* demands, due to the assumed growth in the use of artificial intelligence in the coming years, that we *'urgently deal with regulations on how liability and ethical/moral questions can be answered'*.

Furthermore, on the level of government policy, is the objection of Expert *21HEnE*, who demands that *'our education and social system must change to be able to guarantee equal access to the benefits of digitalisation for all people in the long term.'*

For the development of the labour market, experts also see a loss of jobs, driven by increasing efficiency pressure and the associated greater automation, which will lead to an increase in unemployment (Experts *4SProK* and *6NEnL*). The shortage of skilled workers itself is also responsible for this development, according to Experts *2MEnW* and *6NEnL*.

The statements show that the phenomenon of digital transformation will bring great dynamics to markets (consumption and labour market) in the future. To create

regulations, the experts clearly demand a corresponding framework at the political and legal level, which in turn will influence the individual companies and each individual person but is necessary to counteract unemployment and crime in connection with increasing digitalisation.

5.2.3.8 Brief Summary of the Findings of 'Digital Transformation—General Assessment'

The results of the first section show that an increase in the use of digital technologies is expected. Above all, experts predict an increase in automation. From the company's internal perspective, the associated effects are primarily an increase in efficiency and the potential for further optimisation. Similarly, new business models will be possible through digital technologies, according to experts, which will also lead to new and dynamic sales markets. The need for personnel to perform previously repetitive tasks will shrink, leading to movement on the labour market. At this point, the experts also see it as the duty of politics to help shape events. This also applies to potential criminal threats due to increased digitalisation. Furthermore, the experts stressed that moral and ethical issues must be discussed in light of expected changes. Not least because, driven by the scenarios outlined, significant changes for people and their activities are to be expected.

5.2.4 Section 2.2: Digital Transformation—German Mittelstand Companies

5.2.4.1 Brief Introduction

The next section presents the results of Section 2.2 of the questionnaire of the first round of the Delphi study. In this section, experts were asked to give specific forecasts for the German Mittelstand sector, covering both internal and external aspects. As in the previous section of the questionnaire, a forecast for the next 5–15 years was requested. The following questions were to be answered by the experts:

- Which external influencing factors are directly related to a digital transformation in your company?
- What internal influencing factors are directly related to digital transformation in your company?

- What influence do digital technologies already have on your work processes today, and why?
- What do you think the work processes and cooperation in your company will look like in 5 years?
- What would you add or change in your answers regarding development in the next 15 years?
- What would you add or change in your answers regarding development beyond the next 15 years?
- Do you have further thoughts and ideas in this context that have not yet fitted any of the questions? Then feel free to write them down here.

The final question was an opportunity to share additional thoughts on the section and was answered by 12 experts, the rest answered 'no' here as a release was technically prevented. Like the previous section of the questionnaire, this one also provided extensive responses from experts. The analysis procedure described in Sub-section 4.2.1 was also applied to this part of the questionnaire. *Figure 5-9* shows the main categories and the associated categories developed from the initial codes after the axial coding step for Section 2.2 of the questionnaire. The graph shows on the outer ring the categories that were formed after the axial coding. The coding steps and the number of individual codes can be found in Sub-section 4.2.1. The inner ring shows the main categories which—as in the previous section—were combined in the selective coding after completion of the coding per question, within the entire questionnaire section due to overlaps and considering the temporal aspects of the questions.

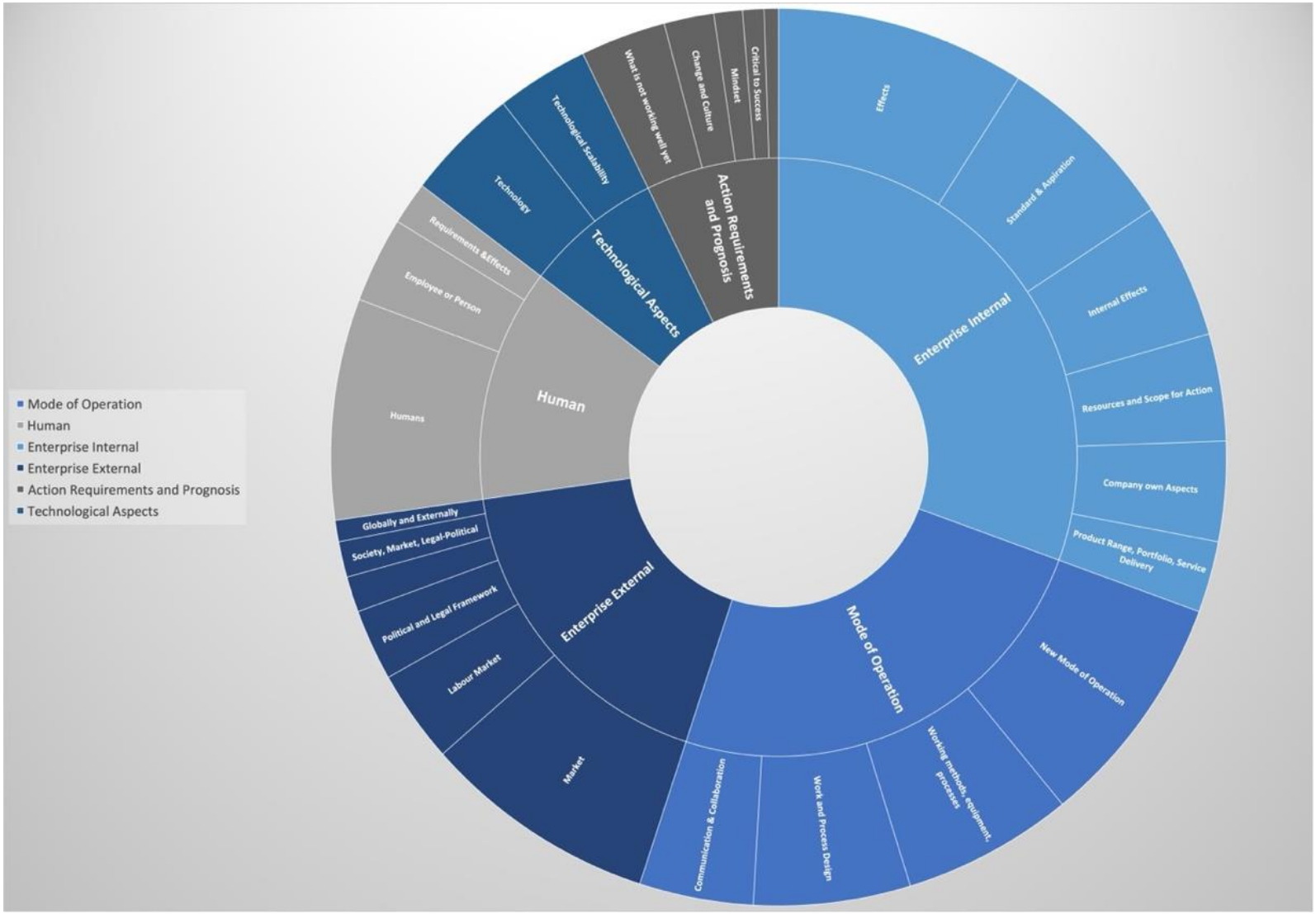

Figure 5-9: Main categories, Section 2.2 'Digital transformation—German Mittelstand companies' Delphi Round 1

The results are presented in the following, based on the main categories.

5.2.4.2 Category 'Mode of Operation'

The main category **'mode of operation'** contains 95 codes from four categories. *Figure 5-10* shows the main category with the assigned categories and the respective number of codes.

Category "Mode of Operation"	
Work and process design	22
Mode of Working	33
Working Methods, Equipment, Processes	24
Communication & Collaboration	16

Figure 5-10: Main category, 'Mode of operation'—Section 2.2—Delphi Round 1.

Statements concerning the design of work processes within the company were included in this category. It also includes aspects that affect communication and cooperation, which also affect the place of work and working hours. Not included in the classification are effects that concern the individual person or the demands on people. Although the effects on the mode of operation have a direct influence on people, as Expert *24NHuM* aptly puts it, *'… Processes are becoming increasingly complex: Where processes can be automated, people gain time for other activities…'* A gain in time is also attributed to the fact that collaboration will increasingly occur de-centrally in virtual teams (Expert *2MEnW*). This aspect is taken further by Expert *13MExS*, who states that in distributed structures and with a high degree of division of labour, *'digital technologies enable the necessary flexibility, the extended availability of information, extended communication possibilities, intelligent work structures, and cooperative working here'*, which leads to more transparency.

According to Expert *12DProK*, digital collaboration will lead to *'significantly fewer real offices and also fewer company cars'* but also to a reduction in official travel time (Expert *7TDiTV*).

The experts' statements clearly show that the degree of automation will increase, which will result in more efficient work processes. Similarly, the experts note that

cooperative work and access to information will increasingly occur in decentralised and virtual structures in the future.

5.2.4.3 Category 'Human'

The next main category in Section 2, **'human'**, includes a total of 49 codes from two combined categories. *Figure 5-11* shows the main category with the assigned categories and the respective number of codes.

Category "Human"	
Humans	31
People (Requirements, Effects)	6
Employee or Human Being	12

Figure 5-11: Main category, 'Human'—Section 2.2—Delphi Round 1.

Within this category in the second section of the questionnaire, statements are at the core that refer to the effects of the mode of operation outlined above on the people in the company. This includes both effects and requirements. Excluded are the already mentioned aspects of cooperation from the previous category, whose effects, however, will, of course, have a direct impact on people. For example, Expert *1DEnD* predicted in this context that *'almost every employee will handle significant portions of their interaction in the company digitally'*, which, according to Expert *7TDiTV*, will lead to the fact that *'the demand on the qualifications of employees will continue to increase'*. This is also supported by Expert *23SHuS*, who sees the need for new competencies for employees despite the possible simplification of some activities. These new competencies are, for example, in the processing and prioritisation of information and the associated self-organisation, as Expert *18TDiTF* described, as follows: *'Overall, however, much more information is being generated. This also changes the way information is handled and prioritised. This forces every employee to prioritise the information. It is noted that many employees, however, do not yet have the competence for such a high level of organisation.'* For Expert *18TDiTF*, the employees are the 'most important factor', and for Expert *4SProK*, even the decisive factor: *'The technology will be there. There is only one decisive factor: the human being.'* Expert *5JHuJ* described *'responsibility, trust, and appreciation'* as the core pillars of the future, which are also

human characteristics that will have to be reflected in rules of interaction and in corporate culture (Expert *12DProK*).

For the experts, people are the central element in the digital transformation. People must adapt to change and new requirements. The increase in automation and information demands corresponding qualifications from people. This influences the culture, leadership and personal responsibility of each individual.

5.2.4.4 Category 'Enterprise Internal'

Within the main categories **'enterprise internal'**, 119 codes from six categories were applied. *Figure 5-12* shows the main category with the assigned categories and the respective number of codes.

Category "Enterprise Internal"	
Offer, Portfolio, Service Delivery	10
Effects	35
Effects (Standard, Entitlement)	26
Internal effects	19
Resources and Room for Actions	15
Aspects internal to the Enterprise	14

Figure 5-12: Main category, 'Enterprise Internal'—Section 2.2—Delphi Round 1.

The category **'enterprise internal'** includes statements by the experts that relate to the portfolio and performance of the companies. Statements about external influences are delimited, as these are processed later, in the category **'external effects and for action'**. On the other hand, included are arguments that refer to the effects of the increasing digital transformation and that have a direct influence on companies. For example, Expert *13MExS* formulates the *'need to implement digitisation steps in order to remain competitive…'*

Competitiveness is argued by the experts on the one hand from the perspective of increasing efficiency and on the other hand, the *'application of digital communication is seen as a market requirement'* (Expert *19BExL*) for *'… customer communication, customer approach, inspiration, customer-oriented business processes, internal processes, and in internal collaboration'*, according to Expert *3PDiTK*. Expert

8DExS also noted that *'... digitalisation allows contact and networking from anywhere and at the same time makes it possible to achieve greater transparency and a better overview, especially in projects'*.

In the future, the experts expect an increased use of artificial intelligence (Experts *25WProR*, *6NEnL* and *13MExS*), such as voice assistants and simultaneous translations (Expert *9NHuT*).

The possibilities as well as the desires of customers and employees make digital communication with colleagues or customers increasingly necessary (Expert *24NHuM*). In this context, Expert *1DEnD* noted that *'the necessary investments in the context of digitalisation are extremely high and difficult for smaller companies to handle on their own'*.

The results within this category have revealed that digital communication, both internally and externally, is an increasing market requirement for companies. Further potential for the use of technologies to increase efficiency, transparency or to optimise processes is seen by the experts.

5.2.4.5 Category 'Enterprise External'

The main category **'enterprise external'** includes 69 codes from six application categories. *Figure 5-13* shows the main category with the assigned categories and the respective number of codes.

Category "Enterprise External"	
Labour Market	13
External	5
External Influences	5
Global or external	3
Market	33
Political and Legal Framework	10

Figure 5-13: Main category, 'Enterprise External'—Section 2.2—Delphi Round 1.

The category '**enterprise external**' includes those statements of the experts that refer to legislation, the labour market or other international and global aspects. Effects

that have already been applied to companies themselves in the previous category are not included here. It is difficult to make a complete distinction, as no company operates in isolation. For example, legislation has an influence on a company. Since this is externally indexed, it is therefore assigned to this category, such as, for example, Expert *1DEnD's* statement: *'Legislation (e.g., in relation to data protection and working hours) is currently in conflict with opportunities for digitalisation.'*

Expert *2MEnW* also commented on the influence of legislation, especially on the challenges regarding data protection and hacker attacks for the Mittelstand and sees a need for action on the part of legislators: *'Legislation, especially in the international/global context, must be standardised in order to create comparable competitive conditions.'* Expert *12DProK* takes this even further and argues that *'there will be major challenges for the states with regard to the speed of digitalisation, sustainable working environments, tax policy, and labour law'*.

In addition to digitalisation, the experts also see sustainability and great international competitive pressure, as well as an increase in employer attractiveness, as major drivers (Experts *12DProK, 10EExW, 22MHuK*). Expert *18TDiTF* concretises this further, with the following forecast: *'The shortage of skilled workers promotes corporate branding; companies want to present themselves as modern/digitalised.'*

The core statements within these categories aim, on the one hand, towards how the company appears to the outside world, both to potential new employees and to consumers, in terms of good competitiveness. On the other hand, the experts show how great the influence of political and legal regulations is.

5.2.4.6 Category 'Action Requirements and Prognosis'

The main category **'action requirements and prognosis'** includes a total of 28 codes from five categories. *Figure 5-14* shows the main category with the assigned categories and the respective number of codes.

Category "Action Requirements and Prognosis"	
Critical to success	3
Mindset	4
Risks or dangers	2
Change, transformation, culture	7
What does not yet work well	12

Figure 5-14: Main category, 'Action requirements and prognosis'—Section 2.2—Delphi Round 1.

The category **'action requirements and prognosis'** summarises statements that are described by the experts as critical to success. Also included in this category are all statements that describe what needs to be improved. Changes, cultural aspects, and threats are also included. Criticism of current conditions in GM companies that focus on leadership is expressed by Expert *11LEnR*, for example: *'In many companies there is a lack of leadership competence, which currently means that many managers are trying to lead in the modern age with old recipes.'* Even more drastic is the assessment of Expert *22MHuK*: *'The long tradition makes it difficult to make quick changes. The success of the past leads to resistance to the future.'*

Expert *23SHuS* attributes a lack of willingness to change more to a lack of openness: *'A major negative influencing factor, however, is the culture, as openness to change is partial to non-existent. The lack of change management unfortunately does not also lead to a change in this attitude.'*

This impression is not shared by all experts, and some even assess it in the opposite way, such as Expert *2MEnW*, who observes an *'... increased willingness to take risks with regard to the will to change existing processes, corporate culture'*.

It can be stated that management plays a central role for the experts in preparing the framework conditions for change. A supportive culture and openness to change is seen as essential by the experts.

5.2.4.7 Category 'Technological Aspects'

The final main category of this second section, **'technological aspects'**, includes 29 codes from two categories. *Figure 5-15* shows the main category with the assigned categories and the respective number of codes.

Category "Technological Aspects"	
Technology	16
Technological Scalability	13

Figure 5-15: Main category 'Technological aspects'—Section 2.2—Delphi Round 1.

'Technological aspects' addresses the technological aspects mentioned by experts in connection with changes within the Mittelstand. Unsurprisingly, automation is again taken up in this category, as before. Here, however, more specific to the processes in German Mittelstand, such as by Expert *6NEnL*, who predicted that *'standardised processes (esp. internal processes such as accounting, assistance functions, etc.) will be automated to an ever greater extent'*. In addition, a growing importance for speech recognition and self-service processes is expected (Expert *1DEnD*), and *'the adaptation of virtual reality and augmented reality will further change the form of meetings and reduce the need for "onsite" meetings even further'*, according to Expert *7TDiTV*.

According to Expert *25WProR*, *'The security and reliability (of the technologies) will significantly influence the speed of the transformation.'*

The answers dealing with the technological effects support the statements from the first section on the general assessment of digital transformation, but refer here to the use and the perception of further development in Mittelstand.

5.2.4.8 Brief Summary of the Findings of 'Digital Transformation – German Mittelstand Companies'

The results in this section show that an increase in automation and the use of digital technologies, in general, is also expected for the Mittelstand. Particularly with regard to efficiency increases, competitiveness, and employer attractiveness, the experts see effects on Mittelstand emanating from the use of technology. To provide a framework for this, the experts believe that leadership and the shaping of the culture in companies play an important role. The experts place people at the centre as an essential component of success. This goes hand in hand with the willingness to adapt to a changed working world, as well as with new demands on people's skills. The requirements for people are at the core of the following section.

5.2.5 Section 3: The Human in Digital Transformation

5.2.5.1 Brief Introduction

In the following, the results from Section 3 of the questionnaire of the first round of the Delphi study are presented. The core of this section was the expected future key competencies. The classification of the two questions into **'essential key competencies'** and **'competencies that promise excellence'** is based on Boyatzis' (2008) understanding of competencies in the design of the questionnaire. This structure is retained in the following for the sake of clarity. A discussion with reference to Boyatzis (2008) follows in Chapter 6.

The experts were asked to answer and justify their statements and explain what their understanding of a competency is. Specifically, this section was guided by the following two questions:

- Explain the three to five key competencies that you consider essential for workers in general to be able to work in a future, digitally transformed world of work.

- In your opinion, what are the two or three competencies that promise excellence in a digitally transformed world of work (regardless of a single job role)?

For this section, a summary in main categories, as described in Sub-section 4.2.1, was dispensed with for reasons of content. Due to the precise nature of the question, the open coding provided a well-structured basis for the subsequent merging into categories in the axial coding, which was useful for the further use of the results. *Appendix 4.2*, 'Coding Book Section 3a', shows examples of the work results after the last coding step. A graphical representation for the categories and associated codes can be found in the *Appendix 4.3* 'Sunburst Diagram—Categories 3a' as an example. The procedure applies to both of the above questions. In this section, the results are presented clearly according to the previously established form.

5.2.5.2 *Category 'Essential Key Competencies'*

The category **'essential key competencies'** includes 109 codes from 19 categories. *Figure 5-16* shows the main category with the assigned categories and respective number of codes.

Category "Future Essential Key Competencies"	
Curiosity	3
Ability to Cooperate	4
Motivation	4
Courage	2
Communication Competence	5
Self-organisation	6
Analytical thinking	3
Strategic Organisational Understanding	8
Creativity	1
Willingness to take Responsibility	1
Openness	16
Empathy	5
Willingness to Learn	15
Social Competence	7
Mindfulness	2
Problem-solving Competence	5
Data and Technology	13
Flexibility	7
Critical Thinking	2

Figure 5-16: Category 'Essential key competencies'—Section 3—Delphi Round 1.

The question underlying this category aimed to get the experts to explain the key competencies that will be considered essential in the future. Of particular importance here was a clear understanding of what the respective expert understood by the mentioned competence. The exact explanation served, on the one hand, to formulate an understanding by means of open and axial coding, which could be used as a basis for the next round of the Delphi study when formulating the statements. On the other hand, this approach laid the foundation for the subsequent evaluation. As shown in the table, some competencies were mentioned more than once. To show how it was ensured that the same understanding was meant, the examples of **'openness'** and **'willingness to learn'** are explained below.

Expert *10EExW* defined openness as follows: *'Openness to new developments and technologies: Technologies change and evolve. Every development should be approached with an open mind before it is assessed too hastily.'*

Expert *2MEnW* described openness more succinctly, as follows: '*Openness to want to develop and accompany processes in a new way.'* Expert *5JHuJ* summarised openness even more globally: '*Openness, the willingness to consider every day as "Day 1".'*

For Expert *12DProK*, openness means the following: *'open mind: the competence to work on oneself and to remain open to strong changes.' Similarly*, for Expert *23SHuS,* was what important was the *'mindset: being open to change'*.

Expert *21HEnE* understands willingness to learn as '*the will to constantly develop one's skills'*, while Expert *3PDiTK* described the willingness to learn as *'lifelong learning: the ability to recognise what has been learned as "old" and to engage in new knowledge again and again'.* Expert *18TDiTF* made a strong reference to the phenomenon of digital transformation in the context of the definition of willingness to learn: '*Willingness to learn: Constantly changing processes requires learning new methods and specialist content from one's own working environment*. *Active participation in digital transformation also requires a willingness to learn.'* This was also highlighted by Expert *4SProK*: '*Willingness to learn: due to the changing framework conditions and increasing complexity, lifelong learning becomes indispensable.'* For Expert *24NHuM,* it is also important to add to the understanding that this applies to every employee: '*Lifelong learning: … No matter what level and in what role, all employees must permanently learn new things, especially outside of their own box. Learning only takes place in a much more self-determined, self-directed, and on-the-job way.'*

The results show that despite slightly different definitions, the underlying understanding of the two examples of key competencies presented is fundamentally the same and not contradictory. The same applies to the other key competencies included in the category. This created the desired basis for the second round of the survey and for the subsequent discussion of the results. Regarding content, the experts' statements

concentrate strongly on soft factors, such as empathy and social competence. Skills such as self-organisation, creativity, flexibility, courage and curiosity are also cited by the experts as future essential competencies. The number of codes is irrelevant and only illustrates the underlying references of the codes within the experts' answers. Only in Round 2 were the experts asked for their assessment of the identified competencies.

5.2.5.3 Category 'Competencies that Promise Excellence'

The category **'competencies that promise excellence'** includes 72 codes from 17 categories. *Figure 5-17* shows the main category with the assigned categories and the respective number of codes.

Category "Competencies that Promise Excellence"	
Creativity	2
Openness	2
Curiosity	3
Analytical Thinking	3
Ability to Work in a Team	3
Organisational Understanding	8
Fun and Commitment	2
Willingness to Take Responsibility	2
Communication Competence	5
Dealing with Knowledge	3
Technology and Data	8
Ability to Cooperate	5
Willingness to Learn	6
Problem-solving Competence	6
Empathy	5
Change and Adaptation	7
(Intrinsic) Motivation	2

Figure 5-17: Category 'Competencies that promise excellence'—Section 3—Delphi Round 1.

In the category **'competencies that promise excellence'**, the same procedure as in the previous category described in Sub-section 5.2.4.2 was used to obtain the results, as shown in the table. Some experts picked up competencies from the previous category. In these cases, the described understanding was also referred to, which is why it was also applied to the present category. As such, only one further example is presented for this category, namely **'change and adaptation'**.

For Expert *16NProK*, *'adaptability to new situations'* is a competency that promises excellence in the future. Expert *12DProK* even referred to the evolutionary theorist Charles Darwin for the necessity of adaptability: *'Adaptability: Darwin's theory has never been more true for the world of work—only those who constantly reinvent themselves and adapt to or help shape requirements will be successful.'*

In the same category, Expert *4SProK* argued that it will be essential to *'have the courage to constantly question what you have already learned and achieved and to change if necessary'.*

In addition to adaptability and the ability to change, experts in this category highlighted similar skills in their answers as in the previous one, such as creativity, curiosity or the will to learn. New aspects were abilities to 'deal with knowledge', 'understanding of processes', 'openness to new ideas', 'organisational change management', 'ability to work in a team', 'enjoy your work' and 'commitment'. As for the previous categories, the number does not imply any valuation and the competencies identified are the basis for the statements and the further evaluation of the results.

5.2.5.4 Brief Summary of the Findings of 'The Human in Digital Transformation'

The results show that experts primarily consider soft factors to be important in the future and in return mention only a few skills that relate to technology or its application. Above all, openness and willingness to learn or change are considered essential by the experts. Skills such as empathy and social competence will be key competencies in the future, as will flexibility and adaptability, according to the experts.

5.2.6 Section 4: Recommendations for Action

5.2.6.1 Brief Introduction

The following section presents the results of the fourth part of the questionnaire. The questions listed below concerned obstacles to the development of the aforementioned future key competencies, as well as about the contribution of an individual person. They also asked about the necessary starting point for measures. Finally, the experts were asked to name what they considered to be the most

fundamental competency and to later relate it to the competencies from the previous section.

- In your opinion, what is the first necessary step that should be taken to develop the competencies of employees in the way you describe for the future digital transformation in your company/German Mittelstand and why?
- What do you consider to be the most fundamental competency that employees should possess in a future digitally transformed working world, and why?
- Where do you see obstacles in the development of the mentioned competencies amongst employees and why?
- What contribution to development can or must the individual employee make? Please describe and justify your assessment as accurately as possible.
- Do you have any further thoughts and ideas in this context that do not yet fit any of the questions? Then feel free to write them down here:

The last section of the questionnaire aimed at different aspects on which experts should comment. Accordingly, examining several questions simultaneously does not make sense in terms of content. To identify the core elements from the answers, the questions were each individually coded (open coding), and the codes were then also summarised in categories only on the basis of the respective question. The only exception is the last question, whose answers were considered due to the reference within the category ‘measures and prerequisites’.

5.2.6.2 Category ‘Obstacles’

The category **‘obstacles’** includes 40 codes from ten categories. *Figure 5-18* shows the main category with the assigned categories and the respective number of codes.

Category "Obstacles"	
Access to demand-oriented Learning Opportunities	4
Lack of Acceptance	4
Convenience	3
Poor Framework Conditions	11
Insufficient Investments	4
Inhibiting Mindset	2
Lack of Basic Requirements	6
Lack of Willingness to Change	10
Lack of Positive Experiences	2
Fear of Developments	2

Figure 5-18: Category 'Obstacles'—Section 4—Delphi Round 1.

For Expert *2MEnW*, for example, one obstacle is that individual employees are only unwilling to change and resist *'actively leaving the comfort zone'*. More fundamentally, Expert *22MHuK* sees a dysfunctional structure as an obstacle to (further) development and change.

According to Expert *10EExW*, one obstacle is that management does not see the need for action: *'Often, those responsible in management have not yet understood the need.'* Expert *25WProR* argued similarly but explicitly referred to the time made available for development: *'Time. I think employers consciously or unconsciously invest too little time in the development of the permanent workforce.'* For Expert *16NProK*, one obstacle is instead that *'HR departments (personnel development) cannot yet develop or buy in the required competencies.'* Expert *23SHuS* also points to a lack of knowledge about the required competencies as a reason for obstacles but sees the lack of knowledge on the part of the employees: *'When I think about the topic of skills management, many employees are not even aware of which further training is necessary for their job. Here, it should be clearly shown which skills can be used to develop in which areas.'*

The results show that obstacles can be found both with an individual employee, if they have a lack of readiness or if there is no knowledge about necessary competence building. The experts also see obstacles on the part of those responsible. On the one hand, in the provision of resources for further training, and on the other hand, in the structural and strategic embedding of this topic in the orientation of the company.

5.2.6.3 *Category 'Measures and Prerequisites'*

The category **'measures and prerequisites'** includes 64 codes from nine categories. *Figure 5-19* shows the main category with the assigned categories and the respective number of codes.

Category "Measures & Prerequisites"	
Leadership	8
Learning and Further Education Offer (Potential Development)	10
Motivation Promote	3
Clear Communication	6
Mindset	5
Understanding	10
Mapping and Analyses	3
Participation	11
Obstacles and Challenges	8

Figure 5-19: Category 'Measures and prerequisites'—Section 4—Delphi Round 1.

In the area of 'measures and preconditions', experts see responsibility primarily in the area of company management. For example, Expert *15GExN* noted, *'Companies are led by company management (i.e., the role model function of CEO is of central importance). Positive examples from the company should be given regularly to all employees.'* In addition, Expert *12DProK* sees visions and images of the future as important to enable employees to understand where a development should go: *'First, employees must be prepared for the changes, (e.g., through visions or images of the future)… Employees need to understand what is happening and, if possible, what the change will be like, in order to be able to support it and not become keepers of the past.'* The aspect of 'understanding' is also a central point for Expert *14MDiTK* to evoke the willingness for change amongst employees: *'Get employees on board, understand and explain processes, understand and explain data. Make sense. Employees must be informed and understand the digital transformation of the company. Only then will they have the opportunity to let their strengths benefit the company.'*

Another aspect was mentioned by Expert *10EExW*, an analysis of the current situation to be able to offer targeted measures derived from it: *'The first step is a*

comprehensive analysis… It is important to offer development opportunities and then create framework conditions so that employees can get involved where they can combine interest or a certain inclination with their skills.'

Creating the right framework conditions as a company management is an essential first step for the experts. To approach this in a target-oriented way, it is important for the experts to analyse the current situation and compare the desired target state. In addition—and this is shown by the exemplary answers—it must be communicated clearly and comprehensibly on the part of the company management or those responsible to put the employees in a position to understand what will be required in the future and why. According to the experts, this is the only way to create willingness amongst individual employees.

5.2.6.4 Category 'Contribution of the Individual'

The category **'contribution of the individual'** comprises 28 codes from eight categories. *Figure 5-20* shows the main category with the assigned categories and the respective number of codes.

Category "Contribution of the Individual"	
Contribute Actively	6
Willingness for Change and Development	10
Awareness for Change	3
Self-Reflection	5
Enthusiasm and Will to Learn	8
Openness	5
Self-Management	4
Organisational Aspects	3

Figure 5-20: Category 'Contribution of the individual'—Section 4—Delphi Round 1.

After it became clear in the previous category that the first central steps are the responsibility of the company management, this category places the contribution of an individual at the core of the consideration. For example, Expert *10EExW* demands, *'Employees must be aware of their potential, express their wishes, and actively contribute.'* Expert *4SProK* also sees the active involvement of each individual as a central contribution and explains this as follows: *'Personal initiative will become one of*

the key competencies of the employee of the future. They must invest some of their private time in further training and prepare for the new situation on their own responsibility.'

Expert *24NHuM*'s understanding of active contribution goes beyond this, as he also calls for each individual to contribute ideas: *'Give feedback in every direction (including upwards) and at all times. It is about shaping the path of digital transformation together—it will not work alone and only in the quiet chambers of the management floors. That is why employees are constantly asked to submit feedback and constructive ideas. What each individual can do is set out on their own path and get to grips with the topics that he or she has not yet mastered.'*

Expert *20BProB* also emphasised the need to demand and use learning opportunities and adds the necessity to be willing to develop: *'The employee must demand learning opportunities! The employee must use learning opportunities! The employee must recognise, understand and allow that the world is changing and that we cannot go on like this. The employee must understand from this that he too has to develop if he wants to continue to play along.'*

On the basis of the answers, it became clear that it will be necessary for each individual to actively contribute and bring along the will to change. To achieve this, questioning one's own abilities and contribution will be just as necessary as being open to change and new demands.

5.2.6.5 Category 'Most Basic Competency'

The last category of the fourth section, **'most basic competency'**, includes 25 codes from twelve categories. *Figure 5-21* shows the main category with the assigned categories and the respective number of codes.

Category "Most Basic Competency"	
Digital Process Design	2
Curiosity	1
Openness	1
Mindfulness	2
Willingness to Change	6
Communication and Cooperation	3
Taking Responsibility	3
Willingness to Learn and Develop	4
Self-Leadership and Self-Organisation	2
Humanity	2
Strengthening Basic Qualifications	2
Courage	1

Figure 5-21: Category 'Most basic competency'—Section 4—Delphi Round 1.

The question about the **'most basic competency'** at this point was intended to sharpen the focus on the competencies after the explanations about obstacles and the contribution of each individual. Thus, later in the discussion, this part of the results can be linked to Section 3 and interpreted in the context of the discussion of results. During the evaluation, it became clear that the experts distinguish in their arguments between 'willingness' and ‚openness'. Willingness therefore requires the employee to actively change something, as is clear, for example, in the argumentation of Expert *3PDiTK*: *'Lifelong learning. This point includes the willingness to change, to step out of the comfort zone to start something new, and the willingness to do it together with others. Without this ability, employees will quickly stop adding value to the company.'* This is also supported by the opinion of Expert *24NHuM*, who also mentioned curiosity as an important competency: *'Willingness to change: Where exactly the journey is going will only be decided as we go, and a lot will change before then. But if people do not start to have a desire and curiosity for change, for new things, for development, we will not make any progress. So, it is about the general competence to be able to leave the comfort zone occasionally.'*

The ability to adapt to change is also emphasised by Expert *7TDiTV*, who assumes that employees will be overtaxed in the future if they fail to do so: *'Adaptability, technologies and processes will change. With or without the employee. If,*

as a result, the job changes without the employee going along with that change, there will be an overload.'

The experts' comments in this last category show that curiosity, open-mindedness, and the will to change and develop are seen as the most important skills and characteristics of an employee in a future digitally transformed working world. The number of codes does not represent a valuation at this point but is solely based on the data analysis. An assessment for this part was also only made by the experts in the second round.

5.2.6.6 Brief Summary of the Findings of 'Recommendations for Action'

The last section of the questionnaire aims to identify obstacles, initial measures and preconditions to clear them out of the way and to work out the contribution of each individual from the experts' perspective. The results revealed interesting aspects that identify starting points at the organisational level when it comes to awareness and the provision of necessary development measures. At the same time, experts note that employees must be able to understand how and in which direction change is happening and what demands this will place on employees. Likewise, experts highlight points for each individual employee that they need to contribute to shape change and adaptation successfully and actively to new requirements in the context of an increasingly digitally transformed world of work. The contributions of an individual are also reflected in the key competency.

5.2.7 Summary of the Findings from Delphi Round 1

The results of the first round of questionnaires provided a large amount of data and insights from the experts. The evaluation and presentation of the results required a high degree of accuracy and good documentation during the process to deal with the vast volume of data. The notes that the researcher wrote down in the form of memos to maintain a defined understanding for the individual codes and later for the categories were helpful and necessary. Despite previous practice in using the analysis software NVivo, process improvements were made in places during coding to maintain an overview and a clean structure.

In terms of content, the results of the first round made it clear that digital transformation is a phenomenon with many perspectives and interactions. Thus, within each of the first two sections, extensive categories emerged on aspects of internal and external impacts within the company, which in turn comprise both interfaces and interactions. Technologies and processes are also interdependent. Experts seem to agree that all these expected changes from and through digital technologies will also have a significant impact on people in companies in the future. This can only remain 'apparent' at this point, because the aim of the first round was to gather information from experts to use as a basis for the second round of the Delphi study. Only in the second round were the perceptions of the experts asked for, which are used for the later discussion of the results and the answer to the RQ of this thesis.

5.3 Round 2: Questionnaire – Statement Evaluation

5.3.1 Introduction

The following section presents the results of the second round of the Delphi study. The basis for this is exclusively the evaluated results of the first round, which were presented in the previous section. The statements for this second round were formulated from the categories emerged in Round 1 (for details on the development of the data collection instrument, see Sub-section 4.3.1.1). The aim of this second round was to obtain a consensus on the individual statements from the experts. In addition, further information or—if necessary—clarifications were to be provided on the statements. To achieve this goal, the questionnaire was again made available to the same expert panel via the LimeSurvey platform via a personal access link. After completion of the survey, the statements were evaluated by counting the answers, the 'fully agree' and 'tend to agree' answers and shown as a percentage. The comments were evaluated for each statement and presented in the findings according to their meaning. All results of this second round serve as findings for later answering the RQ and should provide information on how future key competencies can be advanced in the GM.

The second round of questioning was completed in full by 21 of the 25 experts, a participation rate of 84%. All of the underlying perspectives of the experts were also

represented in the second round, so that none of the perspectives fell completely out of the expert panel—although, as explained at the beginning, the assignment to a specific perspective is not exclusive. *Table 5-2* shows the number of participants in the second round of the study.

Table 5-2: Response rate—Delphi Round 2.

Perspective from the conceptual framework	Total participants Round 1	Total participants Round 2	Response rate perspective Round 2
Human	5	3	60%
Endogenous	5	4	80%
Exogenous	5	4	80%
Process	5	5	100%
Digital Technologies	5	5	100%
Total	**25**	**21**	
Response Rate	**100%**	**84%**	

A reduction in participants is not unusual for Delphi studies, so it is all the more pleasing that with 84%, a sufficiently good level of rigour was still achieved for this round (Howard, 2015).

The structure of the second questionnaire was based on the structure of the first questionnaire. For this reason, the same structure is retained in this section, which is divided into four sections: ‘digital transformation—general assessment’, ‘digital transformation—German Mittelstand’, ‘the human in digital transformation’ and ‘recommendations for action’. Within each section, the structure of the categories has been retained. This was also used as a basis in the questionnaire itself, which is why it provides a good overview for the presentation of results. Within a category, the corresponding statements are included, which were formulated on the basis of the evaluated data from Round 1. For the presentation of the experts’ assessment, each category has a table showing the statement number, the statement itself, a symbol for ‘consensus level reached’ (green plus) or ‘consensus level not reached’ (red X), as well as the percentage agreement per statement. When completing the questionnaire, the experts also had the opportunity to leave thoughts, hints, or comments on the previously assessed statements in a free text field at the end of each category to give further depth and context to the results. The experts were asked to refer to the statement number if this made sense, to enable a clear reference of the comments in the evaluation.

5.3.2 Section 1: Digital Transformation—General Assessment

5.3.2.1 Brief Introduction

The first section of the second round of interviews is divided into five categories; the number in parentheses after the category name indicates the number of statements in the respective category.

- Technology (4)
- Human and collaboration (9)
- Change (4)
- Enterprise internal (5)
- Enterprise external (7)

The tabular representations show which statements reached the consensus level and which did not. In addition, the comments that the experts were able to leave at the end of each category are included in the presentation of results, so that a comprehensive picture of the data situation per category can be achieved.

5.3.2.2 Category 'Technology'

In the category **'technology'**, three of the four statements have reached the consensus level required, as *Figure 5-22* shows.

Category "Technology"			
S-1.1.1	Digital technologies will continue to be increasingly integrated in all areas over the next 5-15 years, thereby becoming more important and more pervasive.	+	100%
S-1.1.2	Digital technologies will increase the degree of automation and replace analogue activities and process steps.	+	90%
S-1.1.3	This development will lead to more transparency, efficiency and to leaner, interlinked processes.	x	71%
S-1.1.4	In the next few years, the main technological drivers will be artificial intelligence, augmented and virtual reality, cloud computing, big data and data analytics.	+	86%

Figure 5-22: Category 'Technology'—Section 1—Delphi Round 2.

The statement ***S-1.1.1*** reached the highest level of consensus. As such, it is not surprising that none of the experts made use of the opportunity to share further thoughts on this statement. For the other statements, some experts left comments that seemed important to them.

For example, for ***S-1.1.2***, Expert *19BExL* added the following note: *'Yes, but I think it is absolutely necessary to keep space for creativity and own thinking and not to base the evaluation for decisions exclusively on digital processes.'*

Expert *6NEnL* asked the following regarding ***S-1.1.3***: *'… "transparency, efficiency and great processes" for whom?'* and differentiates that for technically *'affine decision-makers'* transparency can increase and processes are improved. At the same time, he points out that a *'"normal" employee' tends to 'lose transparency… massively… because (new) systems run completely as a "black box" and the results (from them) are only comprehensible to a few.'* This aspect, also mentioned by Expert *7TDiTV*, thus gives an indication of why this statement has not reached the consensus level.

Three of the experts, including Expert *11LEnR*, put ***S-1.1.4*** into perspective—even though they agree with it—with the following comment for the Mittelstand: *'I believe that "basic digitalisation" alone (i.e., the replacement of paper management and the use of automation; simple example: automatic email forwarding based on email content), will be the first driver in the upcoming years before "deep" technologies such as AI, VR, or Big Data even make their way into the Mittelstand.'*

The evaluation has shown that the statements, with the exception of those on more transparency and further networked and more efficient processes, are rated as accurate. The results from this category show that an increasing integration of digital technologies and a higher degree of automation can be expected in the future. However, the experts' statements also show that both the degree of technologisation and the effects resulting from the use of technologies will vary depending on an employee's area of responsibility.

5.3.2.3 *Category 'Human and Collaboration'*

The second category, **'human and collaboration'**, contained a total of nine statements, seven of which were accepted, as shown in *Figure 5-23*. At the core were the statements formulated on the basis of the categories from Round 1 of the Delphi study.

Category "Human & Collaboration"			
S-1.2.1	Due to the increasing degree of automation, people's areas of activity will change, such as the elimination of repetitive tasks.	+	95%
S-1.2.2	The change in job areas brings with it new demands on people.	+	100%
S-1.2.3	Collaboration will be much more human-centred in the future (5-15 years) due to digital developments.	x	62%
S-1.2.4	For the expected change, a long-term cultural change and the reduction of hierarchy must take place.	x	67%
S-1.2.5	Individuals will be given more responsibility and working time and place will therefore shift to the work result.	+	90%
S-1.2.6	For some people, the changes mentioned will not be feasible, so that there will be two extremes in the next 5-15 years. Those who can and want to go new ways and those who stick to previous structures and are overwhelmed with the change.	+	86%
S-1.2.7	In the future (in 5-15 years), face-to-face events and meetings will be held primarily for team building and relationship building.	+	76%
S-1.2.8	Due to increasing complexity, interdisciplinary knowledge carriers and specialists will increasingly work together - both internally and externally.	+	95%
S-1.2.9	Increased virtual cooperation will make work more flexible in the next few years and regionality will become less and less important.	+	86%

Figure 5-23: Category 'Human and collaboration'—Section 1—Delphi Round 2.

The results show that there is a consensus that an increasing degree of automation will change people's areas of activity, which will bring new requirements as

a consequence.

The indications given by the experts on the rejected statements are interesting. For ***S-1.2.4*** it can be seen from the comments that agreement was not given because a causality between the dismantling of hierarchy and a cultural change was not seen. This aspect was noted by several of the experts; for example, Expert *9NHuT* hinted, *'Cultural change, yes; whether that equates to dismantling hierarchical levels, I don't know.'* This implies that the statement would have been confirmed limited, to cultural change.

S-1.2.7, which barely reached the consensus level, was commented on by some experts with the remark that people are social beings and therefore such a development of face-to-face meetings is not widely expected.

On the second of the rejected statements, ***S-1.2.3***, expert *6NEnL* provided the following note: *'I would say: an employee's working environment will (have to) be more centred on one—the "collaboration" in doubt will not, as probably the vast majority of "contributors" will not be human at all (keyword: AI, automatically negotiated contracts, Hyperledger, etc.).'*

With regard to the effects and changed requirements, the experts see an increase in responsibility for the individual and a decoupling of working time and place of work, as the focus will increasingly be on the result and not on the mere working time. As a result of this change, the experts predict two extremes of employees in the following years: those who can and want to go new ways and those who stick to the previous structures and are overwhelmed by the change.

5.3.2.4 Category 'Change'

At the heart of the category of **'change'** is, above all, the expected development speed, which experts assess as too slow for Germany as a location and still too far from the beginning. There is consensus within the expert panel on this and the other three statements. The overview of the experts' assessment in the category is shown in *Figure 5-24*.

Category "Change"			
S-1.3.1	The pace of change in Germany is too slow.	+	86%
S-1.3.2	We are still in the early stages of change through digital technologies in Germany.	+	81%
S-1.3.3	Different development speeds between digital processes and human processes bring conflict potential and challenges.	+	95%
S-1.3.4	In the future, the speed of change will increase in the next 5-15 years and digital penetration will have reached all levels (corporate and social), which will intensify the effects described.	+	90%

Figure 5-24: Category 'Change'—Section 1—Delphi Round 2..

Complementary thoughts on the speed of development in Germany were given by two of the experts.

Expert *24NHuM* stated, in response to ***S-1.3.1***, *'There is an urgent need for changes towards more collaborative, interactive and interdisciplinary/creative work, especially in the education sector and especially in higher degrees. Knowledge must be more dedicated to understanding instead of short-term consumed input for the next exam (lifelong learning, how do we learn? When do I learn the best myself? Social skills...).'*

Expert *4SProK* stated, in response to ***S-1.3.1***, *'I think progress in Europe in the field of digitalisation and artificial intelligence is too slow. On the other hand, the quality of change is significantly higher than in China and the US, for example, because we are already anchoring the important aspects of ethics and also data protection in the new models.'*

These results emphasise that an increase in speed is to be expected in the future, which will bring greater digital penetration—entrepreneurial as well as social—but also growing conflict potential and new challenges.

5.3.2.5 Category 'Enterprise Internal'

Within the category **'enterprise internal'**, the statements targeted the impact and developments of companies through digital transformation. All five statements

reached the defined consensus level, as shown in *Figure 5-25*.

Category "Enterprise Internal"			
S-1.4.1	There will be more automated, standardised business processes that reduce costs, increase productivity and minimise errors and potential for improvement.	+	86%
S-1.4.2	Products and services will be primarily thought of from the benefit of the target group.	+	81%
S-1.4.3	New (digital) business models are being developed all the time.	+	90%
S-1.4.4	In the future, the meaning of digital innovations for cultural coexistence as well as for working life must be more strongly questioned.	+	86%
S-1.4.5	Adaptation of technologies and related developments in companies will become more dynamic.	+	95%

Figure 5-25: Category 'Enterprise Internal'—Section 1—Delphi Round 2.

According to the experts' forecast, increased standardised and automated business processes will lead to a reduction in costs and an increase in productivity, as well as to ever new digital business models. Consensus was also reached on the forecast that calls for more questioning of the importance of digital innovations for cultural and working life. Two of the experts shared additional thoughts on this statement:

Expert *24NHuM* noted that ethics and sustainability will also play an increasingly important role in future decisions, while Expert *25WProR* added the following regarding ***S-1.4.4***: *'The sense of digital innovations, or their introduction and use, is already sufficiently regulated today by laws, employee representatives, and data protectors. In the private environment, I think everyone should question for themselves at what level of digitalisation dissocial behaviour patterns can be expected. Self-reflection is an essential soft skill here.'*

5.3.2.6 Category 'Enterprise External'

'Enterprise external' includes statements on effects on or from society and the policy framework. Three of the seven statements did not reach the consensus level. The exact overview of the statements and the respective consent levels of each can be found in *Figure 5-26*.

Category "Enterprise External"			
S-1.5.1	An increase in automation and artificial intelligence raises the need for action in terms of ethics and morality.	+	86%
S-1.5.2	The education and social system must be adapted to the changed circumstances in order to give everyone access to the benefits of digitalisation.	+	100%
S-1.5.3	Highly networked digital systems increase security risks through cybercrime and data misuse.	+	90%
S-1.5.4	Optimal use of resources, thanks to digital technologies, leads to greater sustainability.	x	62%
S-1.5.5	Digital developments will counteract the shortage of skilled workers.	x	43%
S-1.5.6	At the same time, digital developments will cost jobs, which will further widen the gap between rich and poor.	x	43%
S-1.5.7	Digitalisation and technological developments, as well as the accompanying changes in the labour market and society, require corresponding political and legal relevance.	+	95%

Figure 5-26: Category 'Enterprise External'—Section 1—Delphi Round 2.

Some experts made comments on statements that did not reach consensus. For example, expert *18TDiTF* commented critically on the statement on sustainability potential (***S-1.5.4***): *'That may be so; however, raw materials are often needed for the technologies themselves, which in turn are not sustainable.'*

S-1.5.5 states that digital developments will counteract the shortage of skilled workers. This statement was also not agreed with by the majority of experts. Expert *4SProK* hinted at why it did not elicit a large agreement: *'The shortage of skilled workers will be partially and in some areas compensated for by this. In other areas, the*

shortage of skilled workers in IT professions is rather intensified by this.'

The statement that digital developments will cost jobs and further widen the gap between rich and poor also did not reach the consensus level. Individual experts noted that in their opinion, there was not necessarily a causality between the development of jobs and the effect between rich and poor. Another comment was made by Expert *23SHuS: '... Only if we do not already take care of up- and reskilling for a longer time like other countries. There will not be any more jobs today, but there will be new jobs for which skilled workers or general staff will have to be trained. The opportunities are greater than the risks.'*

There was consensus, on the other hand, that digitalisation and technological developments, as well as the accompanying changes in the labour market and in society, require corresponding political and legal relevance. Experts also agreed that the education and social system must be adapted to the changed circumstances and that there is also a need for action with regard to ethics and morals.

5.3.2.7 Brief Summary of the Findings of 'Digital Transformation—General Assessment'

Within the first section, the experts' assessments showed that an increasing integration of digital technologies and a higher degree of automation will have a major influence on people's requirements and areas of activity in the future. As a consequence, the experts confirm the assessment that there will be employees who can and want to follow changed paths on the one hand and those who stick to the old and will therefore be overwhelmed by the expected change on the other. For the development in Germany, the experts see a need to catch up and refer, above all, to the design of educational systems and for moral and ethical regulations.

5.3.3 Section 2: Digital Transformation—German Mittelstand Companies

5.3.3.1 Brief Introduction

The second section of the second round of questioning included four categories, with the number of statements indicated in parentheses after the category name in each case:

- Mode of operation (12)
- Human (12)
- Enterprise internal (14)
- Enterprise external and need for action (13)

Here, too, the table shows which statements reached consensus level and which did not. Comments that the experts were able to leave at the end of each category are included in the presentation of results so that a comprehensive picture of the data situation per category can be achieved.

5.3.3.2 Category 'Mode of Operation'

Influences on the manner of working within a company are at the core of the category **'mode of operation'**. Of the total of 12 statements, nine reached the consensus level, as *Figure 5-27* shows.

Category "Mode of Operation"			
S-2.1.1	Within my company, the digital transformation has already led to process optimisations, automation and thus to more efficient workflows.	+	81%
S-2.1.2	In our company, there is a desire for more automation and the increased use of data.	+	95%
S-2.1.3	Due to a high affinity for digital transformation in our management, there is a lot of room for digitalisation projects.	x	62%
S-2.1.4	The lack of skilled workers is a big driver of digital transformation in my company.	x	24%
S-2.1.5	Digital technologies have already made our processes leaner, more transparent and more efficient.	+	76%
S-2.1.6	Flexible and location-independent work has significantly reduced travel time.	+	90%
S-2.1.7	Thanks to the use of collaboration tools and mobile devices, collaboration and communication has improved for our company.	+	90%
S-2.1.8	In the future, access to information will become faster and easier.	+	90%
S-2.1.9	Collaboration will become more accessible (internally and externally) and increasingly remote.	+	95%
S-2.1.10	In the future, there will be a reduction in hierarchical structures.	x	57%
S-2.1.11	Collaboration will take place in interdisciplinary teams.	+	90%
S-2.1.12	There will be far fewer offices in the future and work will increasingly be location-independent to a large extent.	+	90%

Figure 5-27: Category 'Mode of operation'—Section 2—Delphi Round 2.

Digital transformation is already leading to optimisations and more efficient processes, according to the experts. The desire for greater automation and data use will make access to information faster and easier in the future. Other effects of the increasing use of digital technologies will be to make cooperation within and outside the company more flexible and to spur interdisciplinary teams and location-independent cooperation.

A statement that did not reach the required consensus level was ***S-2.1.3***: *'Due to a high affinity for digital transformation in our management, there is a lot of room for digitalisation projects.'* According to Expert *24NHuM*, although the pandemic has brought *'the work structures/organisational models up to speed in many places—collaboration/culture is still lagging behind'.*

The experts do not see the dismantling of hierarchical structures, which was argued by Expert *9NHuT*, as follows: *'Opposing trends. In very complex times of demand, I sometimes even recognise the desire for hierarchy (because of supposedly clearer orientation, decrease in decision-making, etc.).'*

In the future, according to the consensus of experts, collaboration will further improve communication in companies through the use of collaboration tools and mobile devices. Location-independent working will increase and thus reduce travel times and office space (i.e., promote a digital decentralisation in how we work).

5.3.3.3 Category 'Human'

Within the category **'human'**, experts listed and assessed statements that address change in job profiles, activities and requirements for people in companies. Of the 12 statements, a total of four did not receive sufficient agreement to reach consensus. *Figure 5-28* shows which statements reached the consensus level and which did not.

Category "Human"			
S-2.2.1	Job profiles and activities in our company will change in a way that cannot yet be defined.	+	86%
S-2.2.2	Many employees in our company do not yet have the skills to prioritise and process the information generated.	x	67%
S-2.2.3	Within my company, the digital transformation has already led to a different culture of cooperation.	x	67%
S-2.2.4	For us, flexible working with a corresponding culture is important for employee satisfaction and retention.	+	95%
S-2.2.5	In the future, appraisals will be more results-oriented.	x	67%
S-2.2.6	Due to the increasing level of complexity, the demands on individual performance will rise in our company in the future.	+	81%
S-2.2.7	A higher orientation towards strengths in relation to the distribution of tasks will increase, which will demand more self-organisation from the people in my company.	+	86%
S-2.2.8	New skills will be built up in people as the demand for qualifications increases.	+	76%
S-2.2.9	Goals will be achieved through vision.	x	52%
S-2.2.10	Responsibility, trust and appreciation will be the core pillars of the future for us.	+	95%
S-2.2.11	Meeting each other humanely as well as creativity and intuition will become increasingly important for us.	+	81%
S-2.2.12	The decisive factor for change will always be people, because technology exists, but is not an end in itself for us.	+	90%

Figure 5-28: Category 'Human'—Section 2—Delphi Round 2.

According to the experts, the flexibilisation of work highlighted in the previous category influences the design of the culture, which is important for employee satisfaction and retention. However, the expected change is also accompanied by increasing complexity, which will increase demands on individual performance, according to the consensus of experts. As a further effect, the experts see an increasing strengths orientation in the distribution of tasks, which will demand more self-

organisation from people. ***S-2.2.8***, *'New skills will be built up amongst people as the demand for qualifications increases'*, barely reached consensus. Some experts did not recognise any causality in this. For example, Expert *18TDiTF* stated, *'Yes, but not automatically. It has to be steered in by the company, or intrinsically by the employee.'* Expert *20BProB* also argued in this direction: *'The demand for quality is always high and this does not necessarily build up new skills. Can. But it does not have to.'*

For the future, responsibility, trust and appreciation are seen as the cornerstones of cooperation in companies. Human interaction, creativity and intuition will become more important.

Expert *10EExW* summarised her thoughts at the end of the category, as follows: *'From my standpoint, humanity, creativity, and intuition are something that will become more and more essential. I believe that technology can be a catalyst for change. People also need a push for change. Therefore, for me, the decisive factor for change is the combination of people and technology.'*

That this view was also supported by the other experts is shown by the consensus of ***S-2.1.12***, which always sees people as the decisive factor for change, as technology is not an end in itself.

5.3.3.4 Category 'Enterprise Internal'

The category **'enterprise internal'** contained statements that concern the organisation of or effects emanating from an enterprise. Of the 14 statements, eight reached the consensus level (see *Figure 5-29*). Experts see a need for digitalisation to remain competitive. The use of digital communication is also a market requirement.

Category "Enterprise Internal"			
S-2.3.1	The use of digital communication is a market requirement for us.	+	86%
S-2.3.2	Digital processes enable us to achieve greater transparency, better clarity and more effective work in projects.	+	95%
S-2.3.3	We already have many digital channels for faster and more direct communication with our colleagues and our clients.	+	90%
S-2.3.4	Technological requirements are changing our business model.	X	71%
S-2.3.5	Digitalisation is necessary for us to remain competitive.	+	95%
S-2.3.6	Digital opportunities allow us to better scale personnel-intensive services.	+	76%
S-2.3.7	Future decision-making will be based on artificial intelligence.	X	38%
S-2.3.8	Language barriers will be broken down through simultaneous translation and speech recognition.	+	76%
S-2.3.9	Artificial intelligence will have an ever greater impact on systems as well as on people.	+	81%
S-2.3.10	In the next 5-15 years, I do not expect any major leaps in the development of our work processes in our company - based on today's status.	X	14%
S-2.3.11	A big influence on the digital transformation in our company comes from the available resources - time and money.	X	62%
S-2.3.12	The investments for digitalisation are extremely high for smaller companies.	X	38%
S-2.3.13	Our employees must have the time available for digital projects.	+	86%
S-2.3.14	The long tradition and past successes paralyse fast changes in our company.	X	43%

Figure 5-29: Category 'Enterprise Internal'—Section 2—Delphi Round 2.

In terms of increasing efficiency, the experts also confirmed by consensus that digital processes enable greater transparency, more clarity and more effective work in projects. Companies already use many digital channels for faster and more direct internal and external communication. According to the experts, this is also accompanied by better scalability for personnel-intensive services.

One technology that will be increasingly used in the future is artificial intelligence, which will have an ever-greater influence on both systems and people. Within the statement, which reached consensus level, the influence was not further specified, which prompted Expert *6NEnL* to make the following comment: *'At what level? Operationally in day-to-day business, yes! In the management of medium-sized companies, no! Here, the "gut feeling" will remain the decisive factor.'*

Differentiated indications were also given on statement ***S-2.3.12***, which did not reach consensus: 'The investment for digitalisation is extremely high for smaller companies.' Expert *18TDiTF* wrote, *'It depends on the type of digitisation, not on the size of the company.'* Size also plays a role for Expert *23SHuS*, but with regard to the technology to be introduced: *'... for larger introductions of technologies yes, but not to set the basis through standardisation, digitisation, and automation.'*

The statements that reached consensus show that technologies not only influence processes and results in companies but also change internal and external communication. An increasing influence of artificial intelligence was also predicted.

5.3.3.5 Category 'External Effects and Need for Action'

Within the category **'external effects and need for action'**, statements are listed that describe market phenomena, as well as legal and political conditions. Furthermore, statements that contain recommendations for action or aspects that are worthy of attention are included here. Of the total of 13 statements, seven reached the consensus level, as shown in *Figure 5-30*.

Category "External Effects & Need for Action"			
S-2.4.1	The prevailing shortage of skilled workers is noticeable for us.	X	67%
S-2.4.2	To be attractive for potential new employees, digital progress is important for us.	+	90%
S-2.4.3	In terms of communication and data exchange, our customers are demanding an advanced digital transformation of our company.	X	67%
S-2.4.4	Market pressure is clearly noticeable for us due to (international) competition.	X	48%
S-2.4.5	The dynamics of the market shorten the time of our innovation cycles.	X	62%
S-2.4.6	The current legislation with regard to labour law is in conflict with the opportunities of digitalisation, which we can use.	+	86%
S-2.4.7	In the future, the risk of cybercrime will increase for us due to increasing networking.	+	81%
S-2.4.8	Through industries and service fields emerging in the future, new services and value creation will be required from us.	+	90%
S-2.4.9	In addition to digitalisation, sustainability will be a major issue for us.	+	86%
S-2.4.10	Legal regulations in connection with the digital transformation at global and national level will be a challenge and will also have effects on our company.	+	86%
S-2.4.11	Grown structures and bureaucracy are slowing down digitalisation for us.	X	62%
S-2.4.12	The culture in our company is not open enough to drive change, as there are some employees who reject change.	X	38%
S-2.4.13	Leadership plays a central role in change.	+	100%

Figure 5-30: Category 'External effects and need for action'—Section 2—Delphi Round 2.

The requirements confirmed by the experts relate to the demand for legal regulations in connection with the digital transformation at the global and national level. Here, the challenge, as well as the impact, on companies is confirmed. Especially against the background of the expected emergence of new industries and service sectors

in the future, new services and value creation will be demanded from the companies, the experts' assessment showed.

Regarding ***S-2.4.12***, 'The culture in our company is not open enough to drive change as there are some employees who reject change' Expert *7TDiTV* stated, *'I think that the company culture cannot be blamed for the rejection of change. This is about the personal attitude of each employee.'*

For the expected change, experts see leadership as a central role. Against the background of employer attractiveness, digital progress will be important in the future to attract potential new employees. In addition, the aspect of sustainability will also be significant in the future, as the statements that reached consensus show.

5.3.3.6 Brief Summary of the Findings of 'Digital Transformation—German Mittelstand Companies'

The experts' assessment of the statements from this section have shown for the German Mittelstand that an influence of digital technologies is also increasingly expected here. This will lead to further automation and optimisation. Collaboration will also be made more flexible through the independence of location. Due to the increase in information, complexity will increase, which will demand more skills from people in organisations. New business areas and an increasing degree of automation will lead to new job profiles, activities and thus also new demands on people. To shape this change, companies, and above all company management, are in demand, but so is each individual person, who must increasingly practise self-organisation and constantly develop further. Due to the scope of this change, experts also call for adjustments to education systems and legal and political frameworks. Finally, the expert panel also saw a need to react ethically and morally to developments and to create regulations.

5.3.4 Section 3: The Human in Digital Transformation

5.3.4.1 Brief Introduction

Within the third section of this second round of questions, two categories are included, each with the number of statements indicated in parentheses after the category name:

- Future essential key competencies (19)
- Competencies that promise excellence (17)

The tabular presentation of which statements reached the consensus level and which did not is retained for a better overview. Comments that the experts were able to leave at the end of each category are incorporated into the presentation of results so that a comprehensive picture of the data situation per category can be achieved.

5.3.4.2 Category 'Essential Key Competencies'

The intention of the category **'future essential key competencies'** was to obtain assessments from the experts on what they consider to be the elementary characteristics and skills of people in a future digitally transformed working world. For this purpose, the competencies previously defined in Round 1 of the survey were listed within this category for assessment, resulting in a total of 19 competencies. As in the previous categories, the sole aim of the assessment was to determine which competencies reached the consensus level to include them in the later discussion of the results. Within this category, only one statement, namely *'technical understanding of digital technologies'*, did not reach the consensus level. *Figure 5-31* shows all statements in the category, along with the indication of reaching consensus.

Category "Future Essential Key Competencies"			
S-3.1.1	Curiosity	+	100%
S-3.1.2	Cooperative work with others	+	90%
S-3.1.3	Motivation	+	95%
S-3.1.4	Courage	+	90%
S-3.1.5	Communication skills	+	95%
S-3.1.6	Self-organisation	+	100%
S-3.1.7	Analytical thinking in dealing with information and data	+	86%
S-3.1.8	Strategic understanding of business and organisation	+	86%
S-3.1.9	Creativity	+	86%
S-3.1.10	Willingness to take responsibility	+	95%
S-3.1.11	Openness to change	+	100%
S-3.1.12	Empathy	+	90%
S-3.1.13	Willingness to learn	+	100%
S-3.1.14	Social competence	+	90%
S-3.1.15	Mindfulness (of self)	+	76%
S-3.1.16	Problem-solving skills	+	100%
S-3.1.17	Flexibility	+	95%
S-3.1.18	Technical understanding of digital technologies	x	67%
S-3.1.19	The ability to question facts critically	+	90%

Figure 5-31: Category 'Essential key competencies'—Section 3—Delphi Round 2.

The importance of all the key competencies mentioned was also underlined by Expert *10EExW*: *'It is all important… [but] some issues like problem-solving skills can be balanced by strengths in other areas like collaboration.'*

For Expert *11LEnR*, the question is whether 'motivation' should be understood as a competency: *'I don't see "motivation" as a competency. Everyone is motivated if culture, task, environment, and context allow it… With many of the other points mentioned, I constantly have the thought that there must be an organisational openness towards diversity in essence. Some colleagues are strong in analytical thinking (and therefore have tasks in that area), others not at all. The acceptance (or even euphoria) of diversity and the utilisation of different perspectives—true teamwork—is THE key competence of sustainable companies. Even "weak" or "quiet" colleagues can make enormously important contributions.'*

Expert *18TDiTF* also commented on the aspect of introverted characters, following the view that *'introverted characters also find their place, who are not so team-oriented or communicative. They just have to be used differently in the context of digitalisation—that is a leadership issue!'*

The experts' comments clarify that the competencies mentioned, which an employee should have in the future, should at the same time also meet with corresponding organisational and cultural structures in companies to actually have an effect. At the same time, the results also show that experts have reached a consensus that the competencies they have identified will be essential in the future. It can be stated that future elementary key competencies will include curiosity, motivation, courage, creativity, and flexibility. Additionally, analytical and problem-solving skills will be needed, as well as fundamental openness to change and willingness to learn. This will be increasingly under the influence of data—as the previous sections have made clear—so critical questioning as well as a general strategic understanding of business and organisation are also important, according to the experts. As the nature of collaboration changes, it will be indispensable to organise oneself while being mindful of oneself. But working with others will also require empathy and social skills in the future.

5.3.4.3 Category 'Competencies that Promise Excellence'

Within the category **'competencies that promise excellence'**, competencies were identified that, in the opinion of the experts, promise excellence in the future working world of the Mittelstand outlined by the experts. This category was also based on the results of the first round of questioning, which led to a total of 17 competencies. The aim of the experts' assessment was to reach a consensus for the competencies mentioned, and this does not imply any further evaluation. As before, in the category 'essential key competencies', only one competency did not reach the consensus level: *'understanding of technology and data'* (see *Figure 5-32*).

Category "Competencies that Promise Excellence"			
S-3.2.1	Creativity	+	95%
S-3.2.2	Openness to new ideas	+	95%
S-3.2.3	Curiosity	+	100%
S-3.2.4	Analytical thinking	+	90%
S-3.2.5	Organisational change management	+	76%
S-3.2.6	Ability to work in a team	+	86%
S-3.2.7	Enjoyment of what you do	+	86%
S-3.2.8	Commitment	+	90%
S-3.2.9	Understanding of technology and data	x	71%
S-3.2.10	Ability to work collaboratively	+	90%
S-3.2.11	Willingness to learn	+	100%
S-3.2.12	Problem-solving ability	+	95%
S-3.2.13	Empathy	+	86%
S-3.2.14	Adaptability (to situations)	+	90%
S-3.2.15	Motivation from within	+	90%
S-3.2.16	Ability to deal with knowledge	+	95%
S-3.2.17	Understanding of processes	+	90%

Figure 5-32: Category 'Competencies that promise excellence'—Section 3—Delphi Round 2.

Sub-section 5.2.4.3 describes how some competencies outlined in the previous category were revisited by experts. As such, against the background of a competence that promises excellence, competencies from the category 'essential key competency' are also included which reached consensus level here.

One of the new competencies created in this category, ‘fun in your work’, prompted Expert *11LEnR* to re-emphasise the understanding of fun, noting, *‘Is it “fun” or rather “joy”? Fun is something mundane, easy. Joy comes from deep inside; fun is inflationary, joy is more long-term.’* Following from this, he stated that *‘engagement can rarely be prescribed but develops out of joy, appropriate tasks, a healthy context, and good culture’*.

This makes it clear once again that the competencies that a person brings with them—or should bring with them in the future—cannot be seen without the respective context and that they therefore also work within the context. This can be clearly seen, for example, in the ‘ability to work in a team’. No matter how capable an individual may be, if the rest of the team does not work in a team-oriented way, the competence will not be of use to the individual.

5.3.4.4 Brief Summary of the Findings of ‘The Human in Digital Transformation’

The results of the third section have shown that competencies do not stand alone, as skills can only be developed if the context, in this case the organisational and cultural structures in companies, provide the space for their use. Assuming that this is the case, it is clear that competencies such as curiosity, motivation, courage, creativity and flexibility should be present in the future. The experts also emphasised that openness to change must be present.

5.3.5 Section 4: Recommendations for Action

5.3.5.1 Brief Introduction

The fourth and final section of the second round of questioning contains a total of four categories, with the number of statements indicated in parentheses after the category name in each case:

- Obstacles (15)
- Measures and requirements (13)
- Contribution of the individual (7)

- Most basic competence (15)

The tabular presentation of which statements reached the consensus level and which did not is retained for a better overview. Comments that the experts could leave at the end of each category were incorporated into the presentation of results to achieve further depth in the data.

5.3.5.2 Category 'Obstacles'

Under the category **'obstacles'**, statements were listed that, as a result of the data from Round 1, contain both structural deficiencies and obstructive factors at the human level. In total, this category comprises 15 statements, three of which did not reach the consensus level (see *Figure 5-33* for an overview). For example, experts did not confirm that there was a lack of needs-based development offers or that the existing state of affairs was unknown. Furthermore, the expert panel also does not believe that profit maximisation is put before investment in human resource development. However, companies do invest too little time in the development of their employees, according to consensus. Other framework conditions, such as rigid role concepts, much bureaucracy or managers who concentrate on guidelines and control instead of developing potential, were confirmed by the experts as hindrances. According to the consensus, this is also because companies do not (want to) recognise that a digitally transformed working world entails a move away from *'we have always done it this way'*, which will result in these companies not being able to attract and retain talent in the future. However, lack of readiness is a major obstacle at all levels, according to the experts. On the aspect of inhibiting mentality amongst those in charge, as an obstacle to development and change throughout the organisation, Expert *9NHuT* additionally admits, *'Yes, but they will be taken "by the system", grassroots, or sheer mass at some point…'* At an individual level, it is confirmed that there is too much comfort amongst some people, so the insight and will to work on themselves and develop themselves does not emerge. People who stick to the current conditions do so either because they are not ready to change or because they are overwhelmed, and they will not develop the competencies they need in the future, the consensus of the expert panel shows.

Category "Obstacles"			
S-4.1.1	Needs-based learning and development opportunities are not available or not known.	✗	67%
S-4.1.2	There is no analysis or mapping of the status quo of knowledge, so it is often not clear where further development can and should start.	+	76%
S-4.1.3	If companies do not (want to) recognise that a digitally transformed world of work entails breaking away from "we have always done it this way", these companies will not be able to recruit and retain talent in the future.	+	90%
S-4.1.4	If those in charge do not act with patience and realism but with pressure, this will lead to defiance and resistance among the employees concerned.	+	76%
S-4.1.5	A lack of acceptance that personalities react differently to change is an obstacle and results in little room for the development of soft skills.	+	81%
S-4.1.6	For some people, too much comfort is prevalent, so that the realisation and the will to work on oneself and to develop oneself does not arise.	+	76%
S-4.1.7	Framework conditions such as rigid role thinking, a lot of bureaucracy or managers who concentrate on guidelines and control instead of developing potentials are a hindrance.	+	100%
S-4.1.8	Profit maximisation is put before investment in staff development.	✗	57%
S-4.1.9	An inhibiting mindset among those in charge is an obstacle to development and change throughout the organisation.	+	100%
S-4.1.10	People who cling to the status quo, either because they are unwilling to change or because they are overwhelmed, will not develop the competencies they need in the future.	+	81%
S-4.1.11	Companies invest too little time in the development of their employees.	+	76%
S-4.1.12	Lack of willingness to change at all levels (leadership, staff) is a major obstacle.	+	81%
S-4.1.13	Fears, such as being left behind, making mistakes or fear of the unknown, are obstacles to the development of necessary competences.	+	90%
S-4.1.14	The teaching of these competences is a challenge that concerns society, the education system and companies as a whole and must be addressed as such.	+	100%
S-4.1.15	Values and performance assessments need to be adapted and rethought to the new challenges and changes.	+	86%

Figure 5-33: Category 'Obstacles'—Section 4—Delphi Round 2.

In addition to the lack of will, however, fear can also be the reason for a lack of development of the necessary competencies, for example, when people are afraid of being left behind, making mistakes or the unknown. However, Expert *17MDiTR* critically noted, *'Fears always exist, have always existed, and yet people are still there, meaning fears can be controlled and reduced.'* Whether people are actually afraid of the unknown and new things is individual because every individual has a different personality. Accordingly, people also react differently to change. If this fact is not considered, there will be little room for the development of soft skills, according to the consensus of experts. Considering different personalities requires patience and realism. If this is not given, but instead those who are responsible act with pressure to change, it will lead to defiance and resistance amongst the affected employees, the experts confirm. Furthermore, Expert *6NEnL* raised the question of *'whether one wants to "take along" all employees or not. To put it bluntly: In case of doubt, many will simply be "over" in the future'*. Expert *23SHuS* also argues in this direction and confirms, *'Generally yes, but it depends on the context: if a company wants/needs to change, then you cannot wait patiently for individuals, but you should naturally try to bring them along.'*

Teaching the skills needed in the future is a challenge that affects society, the education system, and companies as a whole and must be addressed as such 'and thus,' added Expert *18TDiTF*, *'must also be steered by a country's policies.'* To achieve this, values and performance appraisals must also be adapted and reconsidered in the future to the new challenges and changes, the experts agreed.

5.3.5.3 Category 'Measures and Prerequisites'

Following on from the obstacles identified by the experts, this category **'measures and prerequisites'** includes statements that aim to remove the obstacles and promote the framework conditions for the advancement of the key future competencies needed. A total of 13 statements were evaluated by experts, two of which did not reach consensus, as *Figure 5-34* shows.

Category "Measures & Prerequisites"			
S-4.2.1	Analysing the current situation and setting goals for the development of employees is an important first step in building competences in a targeted manner.	+	90%
S-4.2.2	Learning and development opportunities to develop potential should take into account employees' interests and inclinations.	+	95%
S-4.2.3	Employees must be given the time to try new things and learn through play.	+	100%
S-4.2.4	The framework for development must be given and firmly established in the company, with associated resources and transparent communication about development potential.	+	86%
S-4.2.5	Creating the right conditions also entails investments for the company.	+	76%
S-4.2.6	Development comes naturally when people are given complete freedom to develop.	x	1%
S-4.2.7	Opportunities for digital transformation must be understood as opportunities.	+	90%
S-4.2.8	Leadership should be rethought in companies. Leaders should be role models and above all lead with appreciation.	+	100%
S-4.2.9	Hierarchical structures should be dismantled and employees should be empowered to lead themselves.	x	62%
S-4.2.10	There must be an awareness that the world is changing a lot in order to create an understanding of the need for development in people.	+	90%
S-4.2.11	Encouraging motivation through opportunities for trial and error, a positive culture of making mistakes or other incentives.	+	100%
S-4.2.12	Clear communication of expected changes, goals and related requirements is an important basis for staff development.	+	95%
S-4.2.13	Creating an open mindset, especially at the leadership level, is a key aspect for successful digital transformation with all its facets.	+	100%

Figure 5-34: Category 'Measures and prerequisites'—Section 4—Delphi Round 2.

According to the experts, analysing the current situation and setting goals for the development of employees is an important first step in building competencies in a targeted way. Expert *10EExW* noted, *'When the company analyses, it does not get the whole person, but only a part of their skills and competencies. People themselves should be given more personal responsibility in terms of their development.'*

For this, the development framework must be given and firmly anchored in the company, with the corresponding resources and transparent communication about the development potential. The time needed to try new things and learn through play must also be available to employees in the process. These learning and development opportunities to fulfil potential should consider employees' interests and inclinations. Creating the right conditions also means investments for companies. The experts do not confirm that development will occur by itself if complete freedom of development is given, and express increased critical comments on this, such as Expert *10EExW*, amongst others: *'Complete freedom in development is likely to overwhelm many people. People have deeply rooted beliefs and fears. That means that some people need help understanding what would benefit them. With complete freedom, there is often disorientation. I prefer to talk about the choices and developmental support that people need.'*

At the present time, Expert *25WProR* also fears that they will be overtaxed: *'In my opinion, the majority of employees would still be overtaxed if they were given complete freedom to develop their own potential. Professional tasks would probably be neglected.'*

Expert *11LEnR* also noted that '*too much freedom can also be a hindrance' and that 'there should definitely be guard rails within which the organisation promotes development. Some topics are great (and eventually important) for the individuals but have nothing to do with the roles/tasks of the employees or the vision and mission of the organisation'.*

The experts also reached a consensus that the possibilities of digital transformation must be understood as an opportunity. A rethinking of leadership was needed, so managers should act as role models and above all lead with appreciation.

However, the experts rejected the idea of dismantling hierarchical structures and empowering employees to lead themselves. Expert *4SProK* believes that the dismantling of hierarchies is *'very much dependent on the sector and activity'*. According to Expert *E10EExW*, *'Hierarchical structures can be effective depending on the purpose of the company.'*

Expert *17MDiTR* adds to this point that *'there are also guys you have to lead'*, which is also the task of managers.

Especially at the management level, the creation of an open mindset is a key aspect for a successful digital transformation with all its facets, the experts confirmed. In the future, awareness must be created that the world is changing greatly to achieve an understanding amongst people of the need for development. Motivation could be fostered through opportunities for trial and error, a positive culture of making mistakes, or other incentives. To achieve this awareness and open mindset, it requires clear communication of expected changes, goals, and related requirements as an important basis for human resource development. *'Clear communication of changes, goals, and requirements requires,'* according to Expert *10EExW*, *'that I can do this. Especially in the agile context, this is usually not possible in this way. Vision and meaning must be clear, and short-term goals and measures must be derived from this in a small-step manner'*.

5.3.5.4 Category 'Contribution of the Individual'

A **contribution of each individual** to the measures and prerequisites described above also occurs, which is the subject of this category. A total of seven statements were available for the experts to assess. *Figure 5-35* provides an overview of the consensus level achieved. Except for the statement on the necessity of each individual's contribution, all statements reached a consensus amongst the experts.

Category "Contribution of the Individual"			
S-4.3.1	Active involvement through personal initiative and a living feedback culture are important contributions of employees for development.	+	100%
S-4.3.2	Each individual must have the willingness and desire to develop and change.	+	100%
S-4.3.3	Self-reflection of each individual will be necessary.	+	100%
S-4.3.4	The willingness to acquire new knowledge and build skills in a self-directed and informal way and to renew this continuously is an important prerequisite.	+	95%
S-4.3.5	The openness to change, in terms of working methods, but also in terms of cooperation, must be present in each individual.	+	86%
S-4.3.6	Each individual must take responsibility for himself and his environment, i.e. organise himself and also motivate and discipline himself.	+	86%
S-4.3.7	The co-creation of each individual will be necessary.	x	67%

Figure 5-35: Category 'Contribution of the individual'—Section 4—Delphi Round 2.

The experts see the willingness and desire to develop and change as a fundamental contribution of each individual. This also includes the willingness to acquire new knowledge and build up skills in a self-directed and informal way, as well as to constantly renew them as an important prerequisite. Each individual must take responsibility for themselves and their environment (i.e., organise themselves, reflect and motivate and discipline themselves). However, Expert *18TDiTF* noted in this context that *'there are employees who reject this. A certain amount of leadership is then necessary for this and positions must be found where the employee can still make a contribution'*. The contribution of leadership is also seen in terms of openness to change in terms of working methods. Expert *17MDiTR* believes that working methods and the necessary framework conditions *'can also be achieved through leadership'*.

However, active participation through self-initiative and a lived feedback culture are essential contributions of employees to development, according to the consensus of the experts.

5.3.5.5 *Category 'Most Basic Competency'*

In the final category of the questionnaire, the experts were asked to prioritise the listed competencies. The aim was to check again at this point, after the experts had given their perceptions on the statements about obstacles, measures and a person's contribution, how they stood on the most essential competency. To this end, the experts were asked to list each competency in order of importance. The mentions of each competency were counted, resulting in the list shown in *Figure 5-36*.

Category "Most Basic Competency"	
1	Curiosity
1	Willingness to change
2	Openness to change
3	Readiness for further development
4	Communication skills
5	Willingness to learn
6	Self-organisation
7	Ability to assume personal responsibility
8	Ability to cooperate
9	Courage
10	Humanity
11	Truly taking responsibility
12	Mindfulness (in relation to oneself)
13	Digital process design
14	Strengthening basic skills (basics)

Figure 5-36: Category 'Most basic competency'—Section 4—Delphi Round 2.

According to experts, the most elementary competencies are curiosity, the willingness to change, openness to change, readiness for further development, communication skills and the willingness to learn.

Less elementary, within the choices, were mindfulness (in relation to oneself), digital process design and strengthening the basic skills (basics) rated by the experts. Expert *20BProB* added the comment at the end of the category that *'empathy, intuition and thinking/reflection are missing'* as the most basic competency in the selection. For Expert *10EExW*, establishing a ranking was difficult: *'Humanity is above all, but I think that some people also manage to develop a kind of functional humanity. Whether that is*

a good thing or not is not something I want to discuss here.'

5.3.5.6 Brief Summary of the Findings of 'Recommendations for Action'

The results of the fourth section essentially clarify two aspects: on the one hand, it is necessary to create the right structural framework conditions in companies to advance future key competencies in a digitally transformed working world in the Mittelstand. On the other hand, a digital transformation and the development of future key competencies required for it is not possible without the contribution and willingness of the individual. The experts noted that it is above all the leadership in companies that is obliged to create the right conditions to enable the necessary change and the development of the employees' potential. At the same time, however, this does not release the individual from taking responsibility for themselves and their environment, and from helping to shape the change in a motivated and reflective way and from constantly developing themselves further.

5.3.6 Summary of the Findings from Delphi Round 2

The second round of the Delphi study allowed for a clarification of the results from the first round and a deepening of the data and the associated results. The phenomenon of digital transformation in GM was examined from many perspectives through the evaluation of the statements and the additional comments of the experts. The approach chosen for the implementation and evaluation of the second round has brought further clarity, as hoped. The clear majority of statements that reached a consensus level shows that data from the first round was processed appropriately. The comments—especially those on the statements that only barely reached or did not reach consensus—provide information on the reasons. The evaluation method in Round 2 was much less complex than in Round 1. A clear procedure for checking the consensus level was the biggest challenge due to the relative inexperience of the researcher.

It became clear that the experts—both in general and with regard to GM—expect an increase in automation as well as in the integration of digital technologies. A consensus also exists that these developments will exert a major impact on people's fields of activity and that this will mean that much will be demanded of them. Employees will have to adapt to new occupational fields and to learning new activities

in general. According to the perception of the experts, not everyone will be able to do this in the same way. To shape the change, it is up to each individual to develop further. However, according to the experts, this alone is not enough, so shaping must occur at all levels, whereby above all, company management is obliged to create the necessary framework conditions. This view is underlined by the results from the third section, where the experts emphasise that the required future key competencies can only be developed if the organisational and cultural framework in companies provide the necessary space for this. According to the experts, the essential contribution of the individual for successful development is the openness of each individual. The experts emphasise the importance of promoting developments and consider this to be a central success factor of our time.

5.4 Conclusion of Findings

This research project aims to gain new insights from a group of experts on how to advance the identified future key competencies in German Mittelstand. Against the background of the research philosophy, the experts' understanding of this phenomenon is an important component for the generation of knowledge. For this reason, the question design was drafted accordingly and applied within the framework of the study. This approach was found to work well for this study. On the one hand, this can be seen in the fact that Round 1 of the study served its purpose and produced a deep data base. On the other hand, the results of Round 2 show that the preparation of the data from Round 1 was accurate, according to the experts assessments of the statements. With regard to the substantive findings, it can be summarised that agreement exists that the digital transformation is a phenomenon with interactions in all areas of an organisation. Digital technologies are the driver, but the effects reach into all processes of organisations (and of society) and bring with them a considerable need for development, especially for people. This is due on the one hand to new fields of activity and on the other hand to how people work together. To be able to cope with these altered challenges, each individual must learn new key competencies or adopt characteristics that promote development and change. The experts' contributions also made it clear that the organisation, and especially leadership, must make a major contribution to creating the right structural and cultural conditions for advancing these key competencies.

6. Discussion and Conclusion

6.1 Introduction

In the previous chapter, the results of this research were presented, and essential key findings elaborated. Within the surveyed expert panel, agreement was reached that digital transformation is a phenomenon that is driven by digital technologies but whose effects reach into all areas of organisations in GM. These effects include not only process-related and organisational changes in work but also above all new demands on employees. People in organisations must adapt to completely new activities which, amongst other issues, demand more personal responsibility. In this dynamic development through digital transformation, people must learn new competencies and open themselves to the expected change. According to the experts, this can only be achieved by creating the right conditions both inside and outside an organisation. For the design and development scope within organisations, the experts see leadership as being primarily responsible for creating the framework.

Based on the results, this chapter discusses the findings and links them to the literature outlined in Chapter 2 and to current scientific knowledge in the field to answer the RQs and provide contributions to knowledge and practice. This ultimately leads to the aim of this research study, through the exploration of the digital transformation in German Mittelstand, to understand the phenomenon and its influences within organisations and, based on this, to determine which key competencies will be needed in the future and how they can be advanced. To reach this goal, Sub-section 6.2.1 discusses the aspects of digital technologies, the new mode of operation and the external and internal influences of digital transformation on Mittelstand companies and answers RQ1. In Sub-section 6.2.2, the results of the future key competencies are discussed and linked to the existing literature to answer RQ2. How these future key competencies can be advanced is the subject of discussion in Sub-section 6.2.3, where RQ3 is answered. Sub-section 6.2.4 finally brings together all the aspects considered and discusses the answer to the overarching RQ by adopting SHRM. Finally, the contributions and limitations of this study and, building on this, recommendations for future research are presented before a personal reflection occurs, and the chapter ends this work with a conclusion.

6.2 Future Key Competencies for Digital Transformation in German Mittelstand

6.2.1 Expected Changes Through Digital Transformation in German Mittelstand

6.2.1.1 A New Way of Working

This section discusses the findings on technology (Sub-section 5.3.2.2), mode of operation (Sub-section 5.3.3.2) and change (Sub-section 5.3.2.4) and its impact on collaboration and people (Sub-sections 5.3.2.3 and 5.3.3.3) and links to the literature review in Chapter 2. The joint discussion of these findings considers the fact that the elements can hardly be meaningfully considered separately from each other. The results underline that in the discussion on digital technologies, a change in processes and cooperation and the resulting effect on people must be considered in equal measure. The following discussion is approached accordingly.

The expert panel underlines the prognosis that in the future, the increased integration of digital technologies can be expected and that this will also be accompanied by a higher degree of automation (Schiuma et al., 2022). This finding also supports the view of Makridakis (2017) that digital technologies lead to an increase in data and its processing, as well as increased interaction. Consequently, the conclusion is drawn that these influences bring about a change in the areas of activity, which confirms the findings of Fredette et al. (2012), Walwei (2016) and Makridakis (2017). In terms of impact, however, differences will occur depending on the employees' areas of responsibility. At the same time, this implies that the experts do not assume that there will be areas that will not be affected by change, which is in contrast to the results of the study by Bonin et al. (2015), who assume that only 12% of professions will be affected by automation. Within the results, it becomes quite clear that the experts do not refer much to individual fields of activity but instead follow Polaschek et al.'s (2012) and Greeven and Williams' (2017) view that the rapid acceleration of information processing will impact everyone. According to the experts, this development will be accompanied by an increase in responsibility for each individual, which lies in an increasing orientation towards strengths in the distribution of work and thus requires more self-organisation and responsibility on the part of the individual. This underlines the deep influence of the digital transformation in all areas postulated by Osmundsen

(2020), which also results in a cultural change of work, what Schiuma et al. (2022) call it "a transformative digital culture within the entire organisation" (Schiuma et al., 2022, p. 1276). Interestingly, the experts emphasise that despite the expectation that each individual will have more responsibility, this does not mean that hierarchies will be further reduced. On the contrary, in very complex times exists a greater desire for clear orientation through leadership, according to the Mittelstand experts. Likewise, they do not see any causality between the dismantling of hierarchies and a cultural change brought about by the changed requirements. This underlines recent findings from Schiuma et al. (2022), who see a leader in digital transformation like "a guide for creating a cultural context able to stimulate comparisons and growth spaces to achieve the objectives and make decisions that become a learning environment." (Schiuma et al., 2022, p. 1282). This means that a change in leadership style is associated with a digitally transformed world of work, but it is not accompanied by an elimination of leaders.

With regard to the impact on the relationship between technology and culture, however, the results make it clear that while digital technology can be a catalyst for change, the decisive factor for change is the combination of people and technology (Hartl and Hess, 2017; Schiuma et al., 2022). This underscores existing findings that without integration into a holistic approach to change, the potential of technology is wasted if the culture, strategy and structure of the organisation are ignored (Davenport, 1993; Wastell, White and Kawalek, 1994; O'Neill and Sohal, 1999; Attaran, 2004; Sikdar and Payyazhi, 2014; Hartl and Hess, 2017; Schiuma et al., 2022). However, the design of culture is also important for employee satisfaction and retention, as the results show. It is clear that people are seen as the key enabler of change, as technology is not an end in itself, which underlines Amorim et al.'s (2019) view that it is employees who play the important role in maintaining competitiveness. It is therefore not surprising that another finding is that human interaction and intuition will become more important in the future. A driver for increasing digital collaboration has also been the COVID-19 pandemic (Collings et al., 2021; Eger, 2022). However, the experts see the impact in a very differentiated way; according to their perceptions, while many have modernised their work structures and organisational models, development in the area of

collaboration and culture is slower, which underlines the urgent need for change towards more collaborative, interactive, interdisciplinary and creative working, according to the experts (Kocak and Pawlowski, 2021).

The findings indicate that the view of digital transformation as the cultural, strategic, organisational and operational change of an organisation, industry or ecosystem is shared through the smart integration of digital technologies and processes across all levels and functions. The implication that this dynamic change requires organisations and individuals to constantly adapt their capabilities and interactions to rapidly changing conditions is also emphasised by the findings what echoes other current findings from Eger (2022) and Kocak and Pawlowski (2021). For these developments in Germany, the experts see a need to catch up, and they postulate that this can only lead to success holistically (i.e., it cannot happen in a single organisation but must also include the state, the market, the relevant legislation and education systems). These findings are the subject of the next section.

6.2.1.2 We Are All in this Together

In the previous section, the focus was mainly on the influences and effects of digital technologies on the way people work and what they do. Within this section, the results that show organisational internal (Sub-sections 5.3.2.5 and 5.3.3.4) and external effects (Sub-sections 5.3.2.6 and 5.3.3.5) are discussed, as these have interactions and, according to the researcher, cannot be considered separately.

The results illustrate that as a further consequence of increased automation, productivity gains and cost reductions can be achieved, which aligns with previous research findings (Abdi et al., 2011; Niebel, Rasel and Viete, 2019; Senior, Swailes and Carnall, 2020; Park and Shintaku, 2022; Schiuma et al., 2022). As a further effect, new digital business models can be expected in the future, which in turn supports existing findings (Fredette et al., 2012; Makridakis, 2017; Kocak and Pawlowski, 2021; Gilli, Nippa, and Knappstein, 2022; Schiuma et al., 2022). In this context, however, it also becomes clear that the significance of digital innovations should be questioned, and that ethics and sustainability play a central role for GM. This fact is not surprising given the values attributed to Mittelstand (Welter et al., 2015). Owners will have to ask

themselves about the sustainability potential of digital technologies as part of their responsibility, because although new technologies can often achieve a sustainable effect, they themselves are initially not very sustainable due to their high raw material requirements. Sustainability is explored in the context of digital transformation in a recent study by Park and Shintaku (2022) by examining a comparative case study of Japan and Germany in terms of sustainable human-machine collaborations in the adoption of digital transformation technologies. It is therefore not surprising that the aspect of sustainability is also relevant for the group of experts, but it is not the subject of this study. Nevertheless, it is clear that the use of digital communication channels is a market innovation and can thus be communicated more quickly and directly, both internally and externally, which is important in view of the great dynamics of the markets. The location independence of many activities and services thus also improves the scalability of personnel-intensive services by means of digital networking. Better scalability and increasing transparency can also be achieved through artificial intelligence. It is interesting to note that, according to some of the experts, the experience and intuition of those responsible in GM (owners and thus leaders) cannot be replaced by AI, which underlines the special role attributed to the owner in the Mittelstand (Sharma and Jain, 2013; Roscher, 2015). Schiuma et al. (2022) also conclude in their study on competencies for digital transformative entrepreneurship that it is incumbent on leaders to "communicate the mission, vision and values" and "communicate the purpose of the organisation in a universal language and inspire people (...)". (Schiuma et al. 2022, p. 1285). A key finding shows that leadership in Mittelstand (and thus by definition the ownership) has a central role to play in the expected changes.

Although the management has this central role, it is also clear that the scope for design is also strongly influenced from the outside. On the one hand—as described above—with regard to market requirements in terms of demand and competitiveness. On the other hand, the study shows that political and legal conditions and the education system in Germany must catch up to keep pace with the expected development. Similarly - although not explicitly for Germany - this was underlined by Eger (2022), who postulates that the "effects of digitalisation and technological change (...) not only (affect) the corporate level, but (...) also have ecological, societal and institutional

consequences” (Eger, 2022, p. 11). Eger (2022) also noted that in the context of the digital transformation, changing requirements for skills and competencies "lead to a gap between what companies and other organisations need and the occupational profiles available on the labour market or offered by the current education system, including universities” (Eger, 2022, p. 11), which supports the experts' assessments. So far, learning has been designed for short-term consumption until the next exam, which, according to the experts, contradicts the need to establish lifelong learning, which will be necessary due to the expected changes. Although Eger's (2022) results show parallels to the findings of this study, Eger's study lacks a clear definition of digital transformation as well as a precise delineation of competencies and competencies. Similarly, the survey of students does not do justice to the holistic scope of digital transformation, according to the researcher.

The occupational health and safety law is also seen as outdated; it is not designed for the flexibility that is both enabled by technology and demanded by employees (§5 ArbSchG). The results reinforce the findings from the previous chapter. Based on the findings from this section, the first RQ can be answered:

RQ1: What is the current understanding of digital transformation in German Mittelstand, the interdependencies, the related areas and the impact on the organisations?

In German Mittelstand, digital transformation is understood as a cultural, strategic, organisational and operational change that occurs through the intelligent integration of digital technologies and processes across all levels and functions. Above all, this far-reaching change can only be successfully shaped if people are able to adapt quickly to the changing conditions and they develop the corresponding skills and competencies. In Mittelstand, the leadership of the organisation is seen as playing a central role in advancing this. Nevertheless, a strong influence and interactions from outside through political, legal and educational policies are ultimately also critical for success.

6.2.2 Required Future Key Competencies

The answer to the first RQ makes it clear, amongst other issues, that it is crucial for the success of the digital transformation that people are able to learn or adapt the relevant competencies and skills. The following section of the discussion is therefore dedicated to the second RQ, which key competencies should be available to Mittelstand in the future, and therefore examines the results of Sub-sections 5.3.4.2 (essential key competencies) and 5.3.4.3 (competencies promising excellence), as well as 5.3.5.5 (most basic competency), with references to the literature reviewed in Chapter 2 and recently published research that focuses on competencies for digital transformation.

This work is based on the competence cluster according to Boyatzis (2008) as an understanding of competencies. The view that in a digitally transformed world of work the question of competencies needed in the future goes far beyond technical skills is also followed by other recent studies (Blanka, Krumay and Rueckel, 2022; Gilli, Nippa and Knappstein, 2022). For example, the analysis by Gilli , Nippa and Knappstein (2022) "emphasises the importance of certain personality traits such as proactivity and creativity" (Gilli, Nippa and Knappstein, 2022, p. 1). In the study by Blanka, Krumay and Rueckel (2022), which deals with the "interplay of digital transformation and employee competency" using "A design science approach", "competency is understood as a construct "describing individual behaviour that integrates skills and knowledge, and results in superior performance" (Blanka, Krumay and Rueckel, 2022, p. 3), which is also rooted in the work of Boyatzis (1982) and McClelland (1973).

The underlying understanding of competencies according to Boyatzis (2008, p. 7) was already used in the creation of the first questionnaire. An assignment to these areas according to Boyatzis was not shared with the experts in the questionnaire. There it was simply asked about the 'essential key competencies' and 'competencies that promise excellence'. The 'essential key competencies' was aimed at Boyatzis' threshold competencies:

(1) Expertise and experience;

(2) Knowledge (i.e., declarative, procedural, functional and meta-cognitive knowledge); and

(3) A set of basic cognitive competencies.

In the context of the question about the ‘competencies that promise excellence’, the three clusters of competencies as distinguishing outstanding performance were used (Boyatzis, 2008, p. 7):

(1) Cognitive competencies;

(2) Emotional intelligence competencies; and

(3) Social intelligence competencies.

The question about the most basic competency at the end of the questionnaire aimed to obtain a final impression from the experts after their explanations.

The results, as well as the experts’ comments, clearly showed that all of the competencies (except for those on technical understanding) are considered important in the future. This supports the approach of Boyatzis, who does not see the competencies as alternatives within his clusters, but more as a set of competencies. Blanka, Krumay and Rueckel (2022) come to a similar conclusion and summarise that "The range of competencies has increased due to the immediate and holistic impact of digital transformation on a company"(Blanka, Krumay and Rueckel, 2022, p. 10), although they do not follow the same depth of competency understanding than this study does, as entrepreneurial competency stands in the foreground in their study and no clear literature based distinction of competency types and clusters are formulated.

It is interesting that in the experts’ comments, the question is raised whether, for example, motivation should be understood as a competency. After assigning the competencies to the cluster presented by Boyatzis (2008), it becomes clear that in addition to ‘motivation’, other characteristics named here as competencies can be attributed to the personality of an individual, which aligns with the view of (Gilli, Nippa and Knappstein, 2022). *Table 6-1* shows the assignment of the competencies from the study to the cluster according to Boyatzis (2008). The competencies mentioned that have not reached the consensus level are marked in red in the table.

Table 6-1: Cluster of competencies (adapted from Boyatzis, 2008).

Competency Clusters based on Boyatzis (2008)	Findings 'Essential Key Competency'	Findings 'Competencies that Promise Excellence'
Threshold Clusters of Competencies		
(1) Expertise and experience is a threshold level of competency.	Technical understanding of digital technologies	Understanding of technology and data
(2) Knowledge (i.e. declarative, procedural, functional and metacognitive) is a threshold competency.		Adaptability (to situations) Understanding of processes Ability to deal with knowledge
(3) An assortment of basic cognitive competencies, such as memory and deductive reasoning are threshold competencies.	Problem-solving skills	Analytical thinking Problem solving skills
Clusters of competencies as distinguishing outstanding performance		
(1) Cognitive competencies, such as systems thinking and pattern recognition	The ability to question facts critically Analytical thinking in dealing with information and data Strategic understanding of business and organisation	Organisational change management
(2) Emotional intelligence competencies, including self-awareness and self-management competencies, such as emotional self-	Mindfulness (of self) Self-organisation	

awareness and emotional self-control		
(3) Social intelligence competencies, including social awareness and relationship management competencies, such as empathy and teamwork.	Communication skills Social competence Cooperative work with others Empathy	Empathy Ability to work in a team Ability to collaborate
Not to be assigned to any of these clusters, as they rather target the underlying personality	Curiosity Motivation Courage Creativity Willingness to take responsibility Openness to change Willingness to learn Flexibility	Creativity Openness for new ideas Curiosity Enjoyment of your work Commitment Willingness to learn Motivation from within

It is interesting to note that when experts asked about the essential key competencies, more mentions were made in the cluster area ‘as distinguishing outstanding performance’. On the contrary, when asked about the ‘competency that promises excellence’, those can be placed in the cluster of threshold competencies, significantly more competencies were mentioned. For both questions, some ‘competencies’ were also named that are more personality traits.

This shows that in the future competencies will be considered essential that are categorised as outstanding according to Boyatzis, that is, cognitive, emotional and social competencies. At the same time, competencies that promise excellence will in the future tend to be those that are threshold competencies according to Boyatzis, such as expertise and experience, declarative and procedural knowledge or deductive reasoning.

The results thus show an opposite prognosis to Boyatzis' competency clusters. This means that social and emotional competencies will be essential competencies in GM for digital transformation in the future. In addition, personality traits are playing an increasing role, as was also postulated by Gilli, Nippa, and Knappstein (2022), although it has to be considered that their findings are based on the review of job advertisements and there is no clear definition to distinguish them from competencies.

Personality traits are typically not mentioned to date in Germany in this context. This result underlines the fact that the current vocational qualification in Germany, which focuses primarily on professional competence, technical competence, personal competence, social competence and methodological competence (Delamare Le Deist and Winterton, 2005), does not address the essential need for future key competencies and therefore needs to be enlarged regarding emotional competencies and knowledge about personality traits and their importance for digital transformation.

Boyatzis (2008) himself provides an explanatory approach, presenting ‘competencies and a holistic theory of personality’ (Boyatzis, 2008, p. 8) and a theory of personality, based on McClelland’s (1951) personality theory, as illustrated in *Figure 6-1*. Although the argument that personality needs a more holistic perspective makes sense, this theory is not applicable to this study. The level of ‘motivation and trait drivers of a competency as unconscious dispositions’ as well as the level of ‘value and philosophical foundation of a competency’ cannot be defined on the basis of the study results. This also applies to the level of ‘neural circuits and hormonal patterns to the specific competency cluster’, which Boyatzis oriented to Goleman's (2006) level of ‘findings from neuroscience, biology and medical studies dealing with psychological states and the resulting behaviour’ (Boyatzis, 2008, p. 9). Although it is generally not possible to define the domain of personality in this context, this study claims that the domain of personality is at least comprehensible - if not verifiable - to an discerning reader.

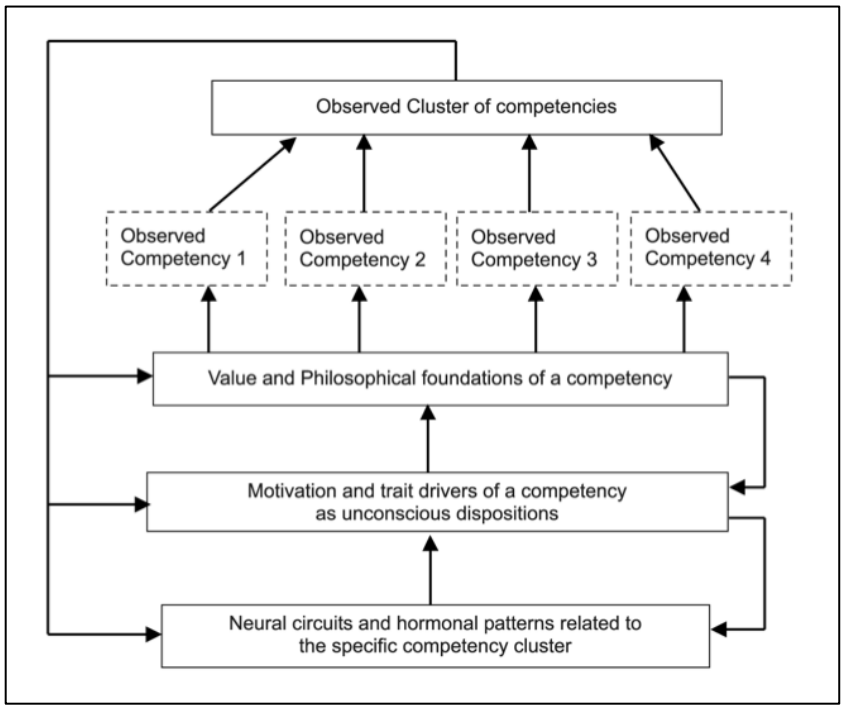

Figure 6-1: Personality theory (Boyatzis, 2008, p. 9).

For this reason, reference is made here to the five-factor model (Goldberg, 1990) for the area of personality traits, which promises a better explanatory approach and is an established and widely accepted model of personality, especially regarding its dimensions, as shown in *Figure 6-2*:

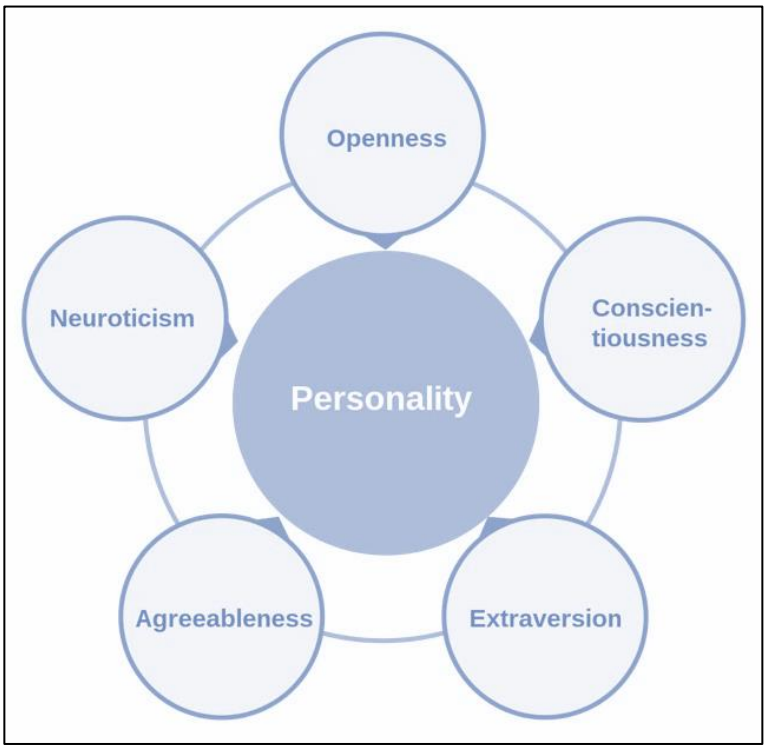

Figure 6-2: Five-factor model of personality (Goldberg, 1990).

Particularly with regard to the aspects of readiness for change and further development described as important in the context of the study, direct allocations to the dimension of extraversion (e.g., with regard to outgoingness and the expected increase in interdisciplinary and collaborative types of cooperation) can be made. Also interesting in relation to the often-mentioned openness is the associated dimension in the model, which includes the also-mentioned aspects, such as curiosity or creativity (Diller, Asen and Späth, 2020; Gilli, Nippa, and Knappstein, 2022). It is conceivable that knowledge about the personality can be used to identify an approach to improving both competencies and competences and reducing fears or resistance in a more targeted way. The present study cannot make this contribution. However, it is interesting to note that the competencies mentioned by the experts and confirmed by consensus, some of which are personality traits, confirm that willingness and openness to change—as described in the context of digital transformation in the Mittelstand—is a critical success factor, which is also underlined by the results of the 'most basic competency' category (Zucchi and Edwards, 1999; Meißner, 2012; Diller, Asen and Späth, 2020). Furthermore, the results show that competencies (referred to as threshold competencies by Boyatzis, 2008) are mentioned less than those that promise excellence. Sub-section

2.5.2 notes that in German, there is no corresponding translation to the English ‘competencies’. Against this background, a classification of the results in German language usage is also necessary. A clear difference lies in the fact that in German, competencies are primarily understood as key vocational qualifications, so it is difficult to consider them on a purely individual level, as is the case here (Delamare Le Deist and Winterton, 2005). This represents an elementary innovation in the field of research on future competencies in the German area, since the findings have clearly shown that essential competencies needed in the future for digital transformation in GM are currently not addressed in vocational qualification. As a consequence the foundation of qualifications lacks these essential competencies (Eger, 2022). This may be because in German the understanding of competence does not include aspects of competencies like presented from Boyatzis in his "Clusters of competencies as distinguishing outstanding performance“. The results and the contribution of this study therefore enlarges the German understanding of competences and obvious why former international studies were not applicable in the German context. As a result of this part of the study, the second RQ can be answered:

RQ2: What future key competencies will result from the digital transformation in German Mittelstand?

Competencies such as expertise and experience, or process-related and functional knowledge, are not reflected in the essential competencies for the future of digital transformation in GM. According to the study results, competencies from the areas of cognitive competencies and social intelligence competencies will become increasingly important. The most profound change in competencies is to be found in the (following Boyatzis, 2008) emotional intelligence competencies referred to here as ‘mindfulness’ and ‘self-organisation’, as no equivalent exists for these in the context of competenc(i)es in German. In addition, personality traits such as openness and willingness to change—which are declared as competencies here in the context of the study—are seen as basic prerequisites for digital transformation in the workplace, which the limited evidence from research on competencies and digital transformation to date also shows (Kocak and Pawlowski, 2021; Blanka, Krumay and Rueckel, 2022; Eger, 2022; Gilli, Nippa, and Knappstein, 2022).

Following on from this second RQ, the question of how to advance future key competencies is discussed in the following section.

6.2.3 How to Advance Future Key Competencies

Within this section, the question of how to advance these future key competencies is answered. The previous results have shown that the field of digital transformation in the Mittelstand is complex and that it requires a different kind of competencies than is usual in the German definition. Concerning the answer to the third RQ, the results of the 'obstacles' (Sub-section 5.3.5.2), the 'measures and prerequisites' (Sub-section 5.3.5.3) and, finally, the 'contribution of the individual' (Sub-section 5.3.5.4) are discussed together.

To approach the answer to the question of how to advance key competencies, it is important to be aware of the obstacles that currently exist. In this regard, the results of the study clearly show that two main obstacles must be addressed by the experts. One is a structural deficiency. As was made clear in the understanding of digital transformation in Mittelstand presented in Sub-section 6.2.1, it is necessary to adapt structures to the changes expected beyond organisational boundaries. A rethinking of values and performance appraisal must be anchored within organisations and in society as a whole. The aspect of adaptation in values in the course of change is not new and is recognised in existing literature (Zucchi and Edwards, 1999; Attaran, 2004; Hartl and Hess, 2017; Gilli, Nippa, and Knappstein, 2022). What is new, however, is the scope that is made clear in this context. Existing literature focuses on change within an organisation, as Hartl and Hess (2017) outline in their Competing Value Framework (CVF) on the role of cultural values for digital transformation. They also refer to interaction with external partners and increased customer centricity as an important component, but as a reactive culture from within the organisation. An appeal that the framework conditions must equally be created by the outside of the company is not discernible, although in the case of Hartl and Hess (2017) the focus does not include the advancement of competencies. Here, the experts postulate a change that must be implemented both internally and externally to create the value system for and thus the basis for teaching and adapting the key competencies that will be needed in the future. The present study cannot reach this scope beyond organisational boundaries. The demarcation is therefore where the

influence of the change of the organisation's external areas ends. More specifically, this means recognising that a great deal of importance is attached to these external factors but that no results can be given about the ‘how’, only impulses. One impulse in this context can be to use the existing networks as entrepreneurs of the Mittelstand (for example, the BVMW), who in turn are heard by politicians as representatives of the Mittelstand. Furthermore, the owner of a Mittelstand company can act as a role model and thus have a positive influence on values in (at least local) society (Sharma and Jain, 2013; Roscher, 2015). As such a role model, the message is also given to the inside of the organisation to establish the required values in this sphere of action, which have been mentioned as necessary for achieving the future key competencies (Gilli, Nippa, and Knappstein, 2022). As described in Sub-section 2.4.1.1, ownership plays a special role in Mittelstand companies, as this person(s) is also responsible for leadership and, depending on the size of the company, management tasks (Lunenburg, 2011; Welter et al., 2015; Bijedić et al., 2018). This implies that originating from the owner is at least a great influence on the actual shaping of the framework conditions in the organisation, which is similar to the findings from Gilli, Nippa, and Knappstein (2022), that the leader plays an important role in digitally transformed working conditions. In view of the obstacles identified in the study with regard to rigid role concepts, much bureaucracy and a control-driven way of acting on the part of managers, the influence on these framework conditions can be used accordingly to create the required environment. The experts' answers showed that in order to overcome this obstacle, a clear determination of the current state by analysing can help to achieve more clarity and thus be a sensible measure to set the right course within an organisation. Knowing the current status and possessing a clear vision is essential for organisations to be able to continuously adapt strategies, processes and procedures, especially in view of the dynamic and continuous change brought about by digital technology (Daft, 2001; Blanka, Krumay and Rueckel, 2022; Gilli, Nippa, and Knappstein, 2022; Schiuma et al., 2022). Achieving this clarity means that at the same time, the corresponding resources and responsibilities must be given or created. To actually have an impact, transparent communication about the expected development and given development potential is necessary. This must align with the goals and visions of the organisation to give the employees guidelines in which they can conduct their development, as was equally

stated by Schiuma et al. (2022). These guardrails are important because complete freedom to develop can lead to people being overwhelmed or missing the goals of the organisation, according to the experts.

As described at the beginning of this chapter, the experts have outlined two main obstacles. The structural obstacles have now been noted and discussed; at the end of the discussion, the people themselves were mentioned as a central element in this context. The fact that people generally have a considerable influence on the success of change has already been emphasised several times in the course of the discussion (Zucchi and Edwards, 1999; Hartl and Hess, 2017; Blanka, Krumay and Rueckel, 2022). From the perspective of obstacles, the results show further aspects that are relevant for taking measures and for their chances of success. Against the background of the key competencies mentioned, it is not surprising that a lack of readiness is identified as a major obstacle at the individual level. Interesting indications are, however, that both convenience and fear are mentioned. With regard to comfort and a lack of willingness, it is ultimately expected that this lack of willingness cannot be turned into will and openness in everyone. To determine whether this is possible, it is helpful to know the reasons for the lack of readiness. If it is fear, for example, it whether this fear arises because of a lack of transparency must be clarified. This can be remedied by clearly communicating visions and meaning, as mentioned above. If the fear occurs because a person does not feel able to build or strengthen the required key competencies but is willing to do so, development programmes and clarity about expectations can overcome this obstacle and counteract excessive demands. In these cases, the support lies with the respective management, which is responsible for the employee and makes the realisation comprehensible and achievable for the employee through short-term goals and measures in small steps. To positively influence the development of potential, the factor of time is also clearly emphasised as a measure for this. Time for personal development should reduce the pressure on people and thus enable them to try things out. According to the results, more joy and interest can be achieved through playful trying out of new things. The measures just mentioned apply not only to those who still lack readiness or clarity but also in general. This clearly shows that addressing people as individuals with their respective abilities and characteristics, which are anchored in personality, greatly influences success when it comes to advancing future key

competencies in Mittelstand. This focus is not yet commonplace in GM.

Consequently, the final essential point is the contribution of the individual, which supports the results on future key competencies from Sub-section 6.2.2. The framework conditions mentioned and the concrete proposals for measures will ultimately work if each individual is enabled to organise themselves and, in this context, also takes responsibility for their own further development beyond development programmes (Blanka, Krumay and Rueckel, 2022). This goes hand in hand with a self-directed and informal development of new knowledge and skills. This realisation is obvious in the context of digital transformation; this is a continuous and very dynamic change which therefore demands adaptations and new skills more quickly than can be considered in the form of measures in organisations. Similarly, it is up to the organisation to be able to make continuous adjustments at both the strategic and process levels (Daft, 2001; Blanka, Krumay and Rueckel, 2022; Eger, 2022). The situational factors, in combination with personal characteristics, in turn have affect the motivation of the individual to achieve their own goals of further development (Heckhausen and Heckhausen, 2008; Berthel and Becker, 2017; Blanka, Krumay and Rueckel, 2022). This closes the circle, to answer the third RQ:

RQ3: How can the identified future key competencies for digital transformation in German Mittelstand be advanced in the future?

The preceding discussion of the results has shown that several factors are relevant for the advancement of future key competencies in the Mittelstand and that these are promising in combination. On the one hand, some structural conditions lie outside the organisation and thus cannot be influenced directly or in the short term, although they also influence successful long-term advancement. On the other hand, there are structural conditions within the organisation that provide a framework for personal development. Leadership is decisive in shaping this framework, both in terms of structural design and supporting individual employees. This does not relieve the individual of the responsibility to develop themselves; essential for this is willingness, which in turn can be positively influenced by leadership through transparent prerequisites and requirements.

6.2.4 Locating the Outcomes in Strategic Human Resource Management

The results so far clearly illustrate the holistic approach to digital transformation in GM, as generally do other recent studies by Blanka, Krumay and Rueckel (2022), who also emphasise the "holistic impact of digital transformation on a company" (Blanka, Krumay and Rueckel, 2022, p. 10), or Hartl and Hess (2017), who state that "holistic changes are required" as part of digital transformation (Hartl and Hess, 2017, p. 1). From the underlying understanding of digital transformation to the resulting future key competencies to the just discussed starting points for advancement, the complexity is also evident in this study. To answer the overarching RQ of this thesis on the basis of the insights gained, the following conclusions in this sub-section are drawn with regard to SHRM, and a model is developed for this context. To counter one of the main criticisms of SHRM research, that it is too circular and that most models lack a broad stakeholder perspective, a new model is developed for this research that compensates for the weaknesses while providing a meaningful framework for action for the findings presented. In doing so, the model developed contributes directly to the field of SHRM research, as to the best of the authors knowledge there currently does not exist any contribution within the given context (Armstrong and Brown, 2019; Collings et al., 2021).

Certain similarities between the conceptual framework developed in the literature review (see *Figure 6-3*) and a well-known model from the early days of SHRM research, the Michigan Model (Fombrun, Tichy and Devanna, 1984), sometimes referred to as the ‘matching model’ suggest a basis for the development of the new model (Berthel and Becker, 2017; Armstrong and Brown, 2019).

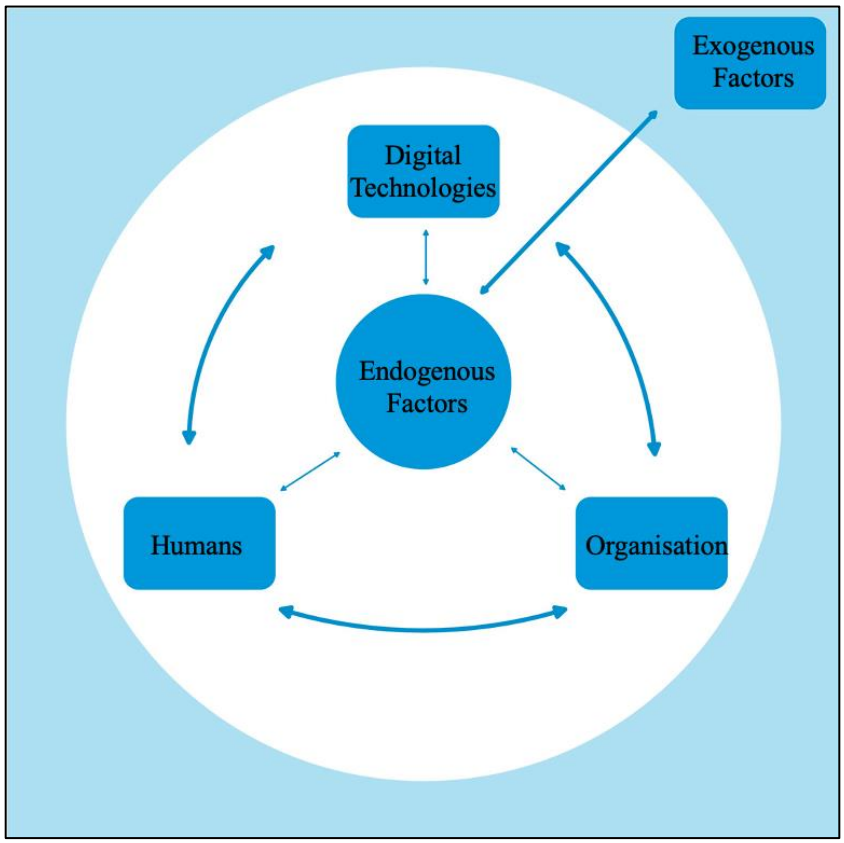

Figure 6-3: Underlying conceptual framework of the thesis from the literature review.

One element of the conceptual framework is the 'exogenous factors', which can also be found in the Michigan Model (Fombrun, Tichy and Devanna, 1984), in the form of 'economic forces', 'political forces' and 'cultural forces'. The important influence of these factors is made clear by the results of this study. *Figure 6-4* illustrates the model as a whole.

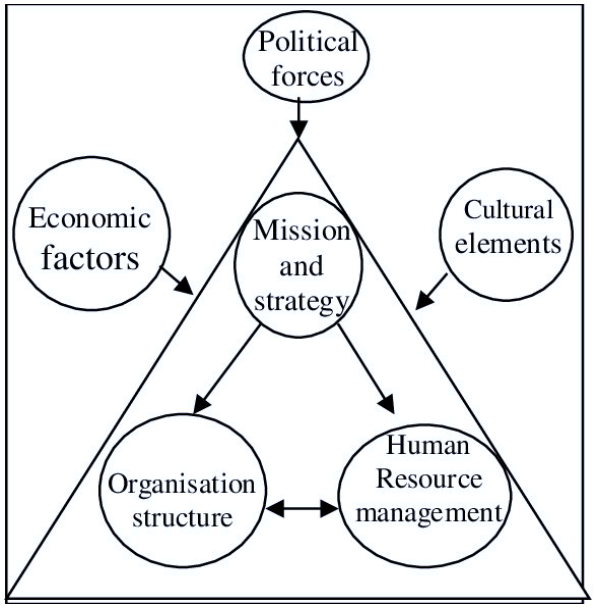

Figure 6.4: Michigan Model of strategic human resource management (Fombrun, Tichy and Devanna, 1984).

'Humans' and 'HRM', as well as 'organisation' and 'organisation structure', can be assigned as equivalents. In the conceptual framework, 'strategy and mission' are included under 'endogenous factors'. It is obvious that there is no reference to digital technologies, as this focus had no relevance in Fombrun, Tichy and Devanna (1984). What differs significantly is the reciprocal dynamic, which is explicitly shown in the conceptual framework. In Fombrun, Tichy and Devanna (1984), organisational structure and HR contribute only to strategy implementation (Berthel and Becker, 2017, Armstrong and Brown, 2019). As such, the model cannot simply be adapted at this point, but it does underline the connections of elements (HR, organisation etc.) already used as a basis in the conceptual framework of this work. Furthermore, following the findings from the future key competencies in Sub-section 6.2.3, in line with Boyatzis (2008), a behaviourist approach seems to be more appropriate for this research and the Michigan Model is attributed more to the development towards the stream to vertical fit (Armstrong and Brown, 2019). As such, the AMO model (initially formulated by in 2003 by Boxall and Purcell) of SHRM is considered as a further model, as one that is 'associated with the behavioural perspective' (Armstrong and Brown, 2019, p. 17). Within the AMO model—as generally within SHRM models—Boxall and Purcell (2016) establish the function that achieves desired performance effects through the interaction of ability (A), motivation (M) and opportunity (O) to promote performance.

Improving performance is not the focus of this study but is implicitly assumed to be the outcome of advancing future key competencies. The aforementioned indicators can be adapted for this context, as *Table 6-2* illustrates. The three dimensions (AMO) from the original model were each expanded by the findings from this study. Ability (A), for example, has been extended to include essential future key competencies (EKC) and competencies that promise excellence (CpE) based on the results. The results that focus on personality traits (P) (e.g., willingness to change, willingness to learn, openness) expand the original dimension (M) of motivation, a further extension of (M)which is incentives (I). The results have shown that specific measures can be provided to promote motivation through playful trying out and adequate time for the development of new competencies. In addition to creating conditions that make this possible, specific incentives can further contribute to employees starting to try out and invest time in developing competencies. In the area of (O) opportunity, too, a further differentiation can be derived from the results. The importance of values and culture (VaC), which are decisively shaped by the owner in German Mittelstand, are an extension. Furthermore, the results showed that collaboration and processes (CaP) are also building blocks that influence the advancement of future key competencies in GM due to the changes that accompany digital transformation. Finally, the aspect of digital technologies (DT) itself is also assigned in the extension, which complements the original area (O). The extension of the AMO Model itself is a contribution to exisisting SHRM research, but in this case it serves as component for the final model which is developed here to answer the RQ.

Table 6-2: Adaption of the AMO model (Boxall and Purcell, 2003) to this research.

AMO Modell		This Research	
A	The **ability** to perform, having the necessary knowledge, skills and abilities to complete the task	**EKC**	Essential Future Key Competencies for Digital Transformation in German Mittelstand
		CpE	Competencies that pomise Excellence for Digital Transformation in German Mittesltand
M	The **motivation** to do the work because there is a desire to do it or a perception of needing to do it	**P**	Knowing and understanding different **personality traits** to promote will and openness
		I	Creating I**ncentives** through time for trying out or playful approaches to trying new things
O	The **opportunity** to perform because the work structure and environment provide the necessary support and opportunities to develop	**VaC**	**Values and culture** within the organisation, determined by the owner
		CaP	**Collaboration and processes** that are adapted to the overall conditions and dynamic developments
		DT	**Digital technologies**, their availability and sensible use

The adjustment presented also considers the two groups of factors that the inventors of the AMO model believe are interdependent around ability, motivation and opportunity to perform (Armstrong and Brown, 2019, p. 16):

(1) The individual's experience, intelligence, health, personality etc.; and

(2) Situational factors of HR policies and practices aimed at creating ‘AMO’ and the associated variables in the production system and organisational context.

Critically, despite the extension of the AMO model presented above, one major factor has not yet been considered: external influences. The results have shown that these are important in this context. Against this background, a new model has been developed.

Although the conceptual framework from the literature review forms part of the basis for the model developed, as the results to RQ1 showed that the relationships, dynamics and interdependencies mapped in the framework reflect the understanding of digital transformation in the Mittelstand, it is not differentiated enough for the results that the study uncovered, so it has to be expanded. The criticisms of the Michigan Model described above is considered additionally, namely that although external influences are adaptable, the interaction of the components shown there is not appropriate for this research. In addition to the external factors from the Michigan Model, the factor of networks is also included here, as the previous section has shown that engagement in Mittelstand networks can at least indirectly influence external influences, such as politics. This is also shown here as an interaction, since networks also offer the opportunity to learn from one another (at the management level) and to see the market from other perspectives, for example, through exchange with other Mittelstand actors. Furthermore, the extension of the AMO model is incorporated. The factors described are each assigned to the respective impact area using the abbreviations from *Table 6-2* introduced earlier and are based on the responses to RQ2 and RQ3. For example, the essential key competencies (EKC), the CpE and the personality traits (P) are assigned to the determinant ‘humans’, as these factors must develop or be advanced in and within the individual. Since—as explained in detail—advancement depends on the other factors, the representation in the original framework is also adequate here. *Figure 6-5* finally shows the developed model, as an outcome from the results and the discussion, which is therefore the central contribution to SHRM research from this study.

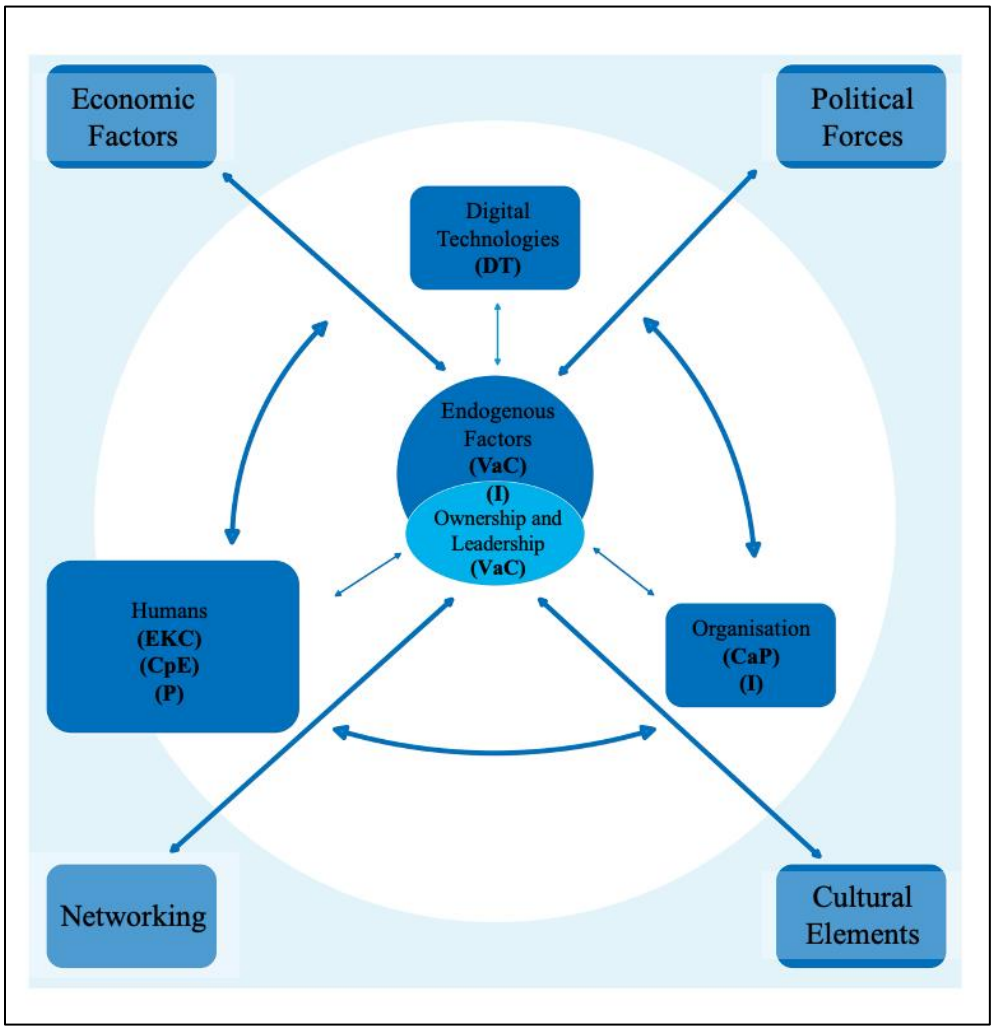

Figure 6-5: Strategic human resource management model to advance future key competencies for digital transformation in German Mittelstand.

At the centre of the model are the endogenous factors, which primarily act from the core into the organisation through the prevailing values and culture (VaC). Closely linked to the endogenous factors is the owner, who, as explained, plays a central role. The values and culture (VaC) are also lived and transported by the owner. In addition, the owner, in his simultaneous role as a leader, also enables incentives (I), such as the incentive to try things out or to provide the space for playful experimentation with new things. The endogenous factors and the owner himself interact with the other internal and external factors of the organisation.

In relation to digital technologies, decisions to invest in digital technologies in GM are also often made by the owner, as the results have shown. Besides the monetary component of a decision for a digital technology, strategic aspects also play a role.

If digital technologies are used in an organisation, they are directly related to work and collaboration processes. Processes are supported, simplified, or automated by digital technologies, which has a direct impact on the way people collaborate with each other. At this point, ‘organisation’ also has the potential to create incentives. When processes and collaboration are actively shaped by people and there are opportunities for trial and error, this can have a motivating effect. This shows that the individual areas interact with each other in a bidirectional way. The motivation just mentioned, for example, has an effect on people and is advanced by incentives created by the organisation or by the owner.

These interactions and influences, which were shown in the previous explanations, are particularly interesting in the context of this model with respect to humans. The aim of this research is to explore how future key competencies can be advanced, so the effect of all other factors on humans is important, as well as humans themselves. The aim of this research was to determine how future key competencies can be advanced, so the effect of all other factors on the human being is important, as well as the human being itself. The results of the study close the existing gap in the question of future key competencies and clearly show that the competencies (essential key competencies and competencies that promise excellence) in the context of the digital transformation in GM must be expanded in particular to include personality traits. For the expected future development of digital transformation, cognitive, emotional, and social competencies are of particular importance. The willingness to actively participate in creating a changed working world in the future and to find their way in it is, in turn, very closely linked to personality traits such as openness or curiosity. The teaching of technical or methodological knowledge will therefore take secondary importance in the future, which is why the design of the work situation, as shown in the model, will become more important in advancing future key competencies.

Finally, the **overarching RQ** can be answered:

How can the identified future key competencies for digital transformation be advanced in German Mittelstand from an SHRM perspective, considering the complex interrelationships and expected developments?

The complex interrelationships of the effects of digital transformation in GM organisations can be made understandable and manageable through the developed model. On the one hand, this is due to the clarity of the influencing factors. Economic, political and cultural factors affect every single person in a company. To enable the advancement of competencies and the necessary mindset for digital change within the organisation, the owner has a special role and responsibility. This offers the opportunity to overcome the otherwise oft-criticised weaknesses of intentional SHRM practices (Armstrong and Brown, 2019), as the owner not only defines strategic decisions but, as a role model and bearer of values, can also significantly influence their realisation. This is also the basis for overcoming another weakness of SHRM, its relevance to practice. Through interested owners or with the help of specialised consultants, the model and its implementation can find a good way into the practice of GM companies. As a central aspect, the interests of an individual person (employee) as well as their characteristics have been analysed in detail in the framework of the study, which shifts an otherwise rather common stakeholder perspective of SHRM in favour of employees. Against the background of the better motivational understanding in the model, a connection and further development with reference to job design can also be developed in the question of a later design of jobs and work.

6.2.5 Conclusion

The results enabled a structured and theoretically sound answer to the RQs, which led to the development of a model that can mitigate the weaknesses of SHRM approaches often postulated in the literature by taking a differentiated view and including the complex interdependencies. In addition, the findings show ways in which the identified future key competencies can be advanced in corporate practice.

6.3 Contributions

The contributions of research within a DBA arise from both professional practice and knowledge in the field. This thesis therefore contributes to professional practice and knowledge in the field of competence research and SHRM, but also—through the modification of the GDM—to methods. These are presented in the following.

6.3.1 Contribution to Method

The GDM as a combination of Delphi method and grounded theory uses data collection methods from the field of Delphi studies and data analysis methods from grounded theory to compensate for known shortcomings of the individual methods. Due to the relative novelty and limited use of GDM so far, there is no clearly established procedure. For this research, the approach of Howard (2015) was used. To compensate for the weaknesses identified there, a possibility for Phase 1 of the Delphi survey was created due to the data collection by means of an open-ended online questionnaire, which overcomes the limitations of time and place that, for example, focus groups entail and thus reduces the risk of having too few participants and positively influences the implementation. In addition, it does justice to the claim that the Delphi method is a structured group discussion process, which, however, requires anonymity within the expert panel to avoid group dynamics in the formation of opinions. In addition, the design of the second round of Howard (2015) was refined by giving more response options and not linking the possibility of comments by the experts to a specific response option, which in turn results in more data and a differentiated understanding. These improvements lead to clear and rich results for this study and the procedure were described in detail thus the modified approach is adoptable for others researchers.

6.3.2 Contribution to Knowledge in ‘Strategic Human Resource Management’

In the field of SHRM, this study makes several contributions. Firstly, it closes the gap criticised by Collings et al. (2021) regarding the effects of the work context. Second, it fulfils the call for greater consideration of the stakeholder perspective (Collings et al., 2021), as also clearly called for by Armstrong and Brown (2019). By extending the AMO model and combining it with the conceptual framework and the

Michigan model (Fombrun, Tichy and Devanna, 1984), the development of a new model that meets these requirements and takes into account the multiple influencing factors has led to a new SHRM model for digital transformation in GM, thus contributing to the existing research in the field of SHRM. As the aim of this research was not to develop an appropriate SHRM model, but to use it to achieve the goal, a new model was developed that not only considers such a broad perspective, but also focuses on one of the most contemporary issues facing organisations today: dynamic and complex changes due to digital transformation. With best of the author´s knowledge this work is the first one that combines competency research with SHRM in the field of digital transformation and shows that the phenomenon of digital transformation, which is a strategic, cultural, organisational change initiated by the growth of digital technologies, is to be addressed primarily by means of a holistic, behaviourist approach at the strategic level. This research therefore contributes to the field by giving a starting point to further elaborate the combination of competency research and SHRM Models for a dynamically chaning world of work due to technological revolutions and at the same time provides a framework for action for the practical field with the developed model.

6.3.3 Contribution to Knowledge in ‘Competencies Research’

Competencies are a central element of this research and were accordingly a large part of the study. The setting here is GM, which is why it was first necessary to clarify understandings of competencies. This is interesting because there is no translation or thus clear equivalent in German for the English ‘competencies’. However, the results showed that the perceptions and forecasts of the experts were close to the differentiated understanding of competencies according to Boyatzis (2008). At the same time, however, the assumptions of the experts is the opposite of the assignment of competency clusters, which Boyatzis (2008) makes. Therefore, one contribution of this research is that in the future essential competencies will be those which, according to Boyatzis, are classified as "clusters of competencies as distinguishing outstanding performance". It is primarily a novelty for the German-speaking world that competencies from this area like emotional competencies are considered essential. In addition, the results show that personality traits are an essential aspect, which, although

not clearly defined, are nevertheless named as important in the future in close connection with future key competencies. This represents an expansion of the understanding of competence in Germany. At the same time, it enriches the findings from Gilli, Nippa, and Knappstein (2022), who investigatet competencies only for those responible within an organisation (namely the leaders) and based only on analysing job advertisements and are mentioning personality traits in this context as well, but without differentiating them explicitly from competencies. Furthermore, the contributions this study makes go beyond similar work from Blanka, Krumay and Rueckel (2022), who seem to follow a competency definition equal to this study. Their study combines IS and management research and does not evaluate competency understanding in the depth. Therefore, this work can make a more nuanced and in-depth contribution to competency research while looking at the influences within digital transformation from many angles, which is a novelty in previous research. This research is an important first step for understanding competencies in a digitally transformed world of work. This study thus contributes to the literature by laying the foundation for future research on competencies for digital transformation and at the same time combines the field of SHRM in the light of digital transformation for the first time.

6.3.4 Contribution to Professional Practice

The contributions to knowledge also enable contributions from this research for professional practice. Firstly, a structured and comprehensive understanding of digital transformation in GM was developed through the study results and the model derived from them. This enables owners in Mittelstand to understand the areas of impact of strategic decisions in connection with digital transformation. In particular, the importance of people and their competencies closes a gap in previous findings (von See, 2019). The findings clearly point out that in the future it will be essential for people to build up appropriate competencies, especially in the area of emotional and social competencies. It also became clear that another factor is the personality of people in order to adopt change through digital transformation. Through this contribution, GM leaders are able to respond to this need. In the context of technologically driven change, this is a novelty, because previously the digital technologies and processes were the primary focus of these changes, and the empowerment of people was aimed at the

operation of the technologies, but not at the associated change.

Another contribution for GM, and for the German-speaking area in general, also emerges from this work. The term competency has no German translation. In German, different types of competences are also differentiated into procedural, technological, cognitive or social competences, but there is no equivalent to the English competencies, as here according to Boyatzis (2008). However, the results have made it evident that the competencies understanding is able to more comprehensively represent what people will need to work in a digitally transformed world of work in the future.

With this insight, leaders in GM can take targeted measures to support their employees in building these competencies. This leads to another contribution of this work. Targeted and long-term measures to empower employees for the digital transformation must follow a corresponding HRM strategy. These measures can have a positive impact on the culture by, for example, allowing more time and space for trying out new things in a playful way, offering rewards (gamification) for training or increasing transparency about what is new and why (technologies) to reduce fears and rejection.Furthermore, thanks to the contributions of this research, it is now possible to adapt both human development in organisations and already the recruitment process with regard to the newly gained knowledge about future key competencies and to plan appropriate measures within the framework of a SHRM.

Typically, however, companies in GM do not have a SHRM department. Rather, strategic decisions are primarily made by the owner. The developed model enables an owner to take differentiated measures and at the same time to consider the interdependency of effects. In addition, specific consultancy firms can be called in to provide support for these measures.

The model shows explicitly that influences do not end at the boundary of the company. As the results underline, exogenous factors from politics, economics, culture and networks are also important for future developments. It became clear that owners in the Mittelstand also have a responsibility to positively influence change in the exogenous direction. This work thus highlights the contribution that in GM the owner has an important role as a paragon that needs to be known and lived.

6.4 Limitations

In the course of the work, individual delimitations have been made, which thus represent limitations of this research. These are, to begin with, the further investigation of personality in relation to the required competencies presented in sub-section 6.2.2. With regard to the findings on competencies, a clear limitation must be drawn that due to the qualitative design and the generation of new knowledge from a social constructivist perspective, the research cannot be generalised through the versions of the world that are subjectively constructed, in this case by the experts (Flick, 2009). Furthermore, it must be self-critically noted that the experts were selected from the researcher's wider personal network, which does not exclude a bias towards views similar to those of the researcher (Häder, 2014).

Moreover, the subject of the study, German Mittelstand, was not further differentiated. As described, the understanding is based primarily on qualitative characteristics. Nevertheless, factors such as the size, industry or age of the company (start-up versus old economy) are distinctions that were not considered here, as long as the criteria of Mittelstand were generally considered to be fulfilled. This therefore specifically excludes other forms of enterprise, such as large enterprises or micro-businesses, which were previously demarcated from GM. Due to the focus on German Mittelstand as the object of study, international organisations are also a limitation of this study. Another limitation is the general scope on people, without considering job role or hierarchical position.

The researcher was aware of these limitations, so they were already mentioned in the thesis. Since the aim was to gain knowledge about future key competencies for digital transformation in Germany and their advancement, it is important to keep the limitations in mind, but they do not diminish the contributions that this work makes. Rather, they show potential for further research, as described in the next chapter.

6.5 Implications for Further Research

Implications for further research can be derived directly from the limitations. An interesting approach would be to test the generalisability of the identified competencies based on the assignment to Boyatzis' (2008) competency clusters in a quantitative study.

A survey of a large number of people from the Mittelstand could provide insights for this. It would also be interesting to examine in the survey whether the competencies mentioned differ according to the role (hierarchy, function) of the participant. A further differentiation in a survey could also be the industry. It would also be interesting, based on such a survey, to make direct comparisons with international companies or to identify regional differences within Germany (rural areas vs. conurbations). Furthermore, a study on the interdependencies of the components presented in the model would be an enriching review to better understand and examine the influences of the individual components in detail.

In addition, a comparison of the competencies and their respective development in the long term would be a further research approach. Potential for further research is offered by the findings on the importance of personality in the context of digital transformation and future competencies. The question of whether a specific personality structure reacts more or less to certain factors from the model would help to plan measures even more precisely in the future.

Since the results clearly show that external factors have an important influence on the advancement of future key competencies, research from the perspective of politics or education would be another starting point for the future.

A study with a similar objective, not in the Mittelstand, but in a micro-enterprise, a large company or comparing one of these companies, also seems interesting. The object of study, the German Mittelstand, could also be further subdivided, for example into start-up and old economy. Finally, further research would also be enriching to examine the understanding of the Mittelstand used here. The underlying understanding of GM is above all a self-understanding that is not based on measurable factors. Examining the self-understanding in order to subsequently test the SHRM model of this thesis would be another approach for further research.

6.6 Personal Reflection

At the outset, experienced researchers and lecturers often point out that this DBA journey is not a linear process. When examining a phenomenon from so many angles, representation and exploration takes several loops and is sometimes fraught with

moral setbacks; life goes on in parallel with this research. In retrospect, this has led to a significant development in my ability to change perspectives in situations and to question facts in a more reflective way. Before I started my DBA, I was more driven by my emotions. Personally, I used to focus more on short-term enthusiasm of topics and tasks. I found it difficult to stay with a topic for a long time and in depth. Research has given me that perspective. Now I plan more and look more closely. I question more after initial enthusiasm and evolved in terms of my analytical skills. This has been especially noticeable at the beginning of the research process. From the enthusiasm for my research idea, which was driven from my professional practice and questions, or challenges posed there, it was an enormous developmental step to undertake the stringent processing of the existing literature in order to develop a proper problem formulation for my work and to clearly define the scope for it. For me personally, this also led to questioning and delimiting information and contexts more closely. Likewise, I had to learn that even fewer exciting tasks, which are more associated with diligence and perseverance than with fun, are parts on the way to achieving goals, which has allowed me an enormous development for my self-management in the organisation of my professional everyday life. Thanks to the analytical skills I have acquired, especially through working with my collected data, I see today, at the end of this journey, how much this work on the study will support me in the future, both professionally and personally, to structure and deal with complex and challenging situations into manageable parts.

All the more I can say that this DBA journey has grounded me and made me stronger, because without this honest self-reflection on the whole time and without the people who accompanied me on this journey, I would not have been able to master these years, this journey and especially my personal loss.

6.7 Concluding Summary

The field of investigation of digital transformation in GM has many facets. By means of the chosen approach, it was possible to define a framework for action right from the start, to guide the scope of the research, on the one hand, and consider the complexity, on the other. The research design has consistently continued along this path and thus enabled a social constructivist view of the realities of the experts from the

midlands. On the basis of the results, the RQs could be structured and answered in the desired depth, so that a model was developed as a central finding from this work, which both provides a good basis for further consideration from a theoretical perspective to explore further aspects and also provides clear recommendations for action and clarification for use in operational practice from a practical perspective.

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Appendixes

Chapter 3

Appendix 3.1: Evaluation of Possible Suitability for Adaptation of Data Analysis from other Delphi Studies

Statistics-basedfinalfinalfinalfinalCriteria // Study	Anonymity within the expert panel	Location independence	Idea generation	Understanding of the process according to the experts	Feedback on content and criticism from the experts	No ranking (consensus building) necessary	Possible adaptation
Kamsker, S. Digital transformation and the design of curricula at Austrian universities. Delphi study on the development of curricula in business studies and business education.	yes	yes	yes	precedes the Delphi study	No. No more at the time of the Delphi study, since quantitative evaluation and assessment	no. Ranking is done by quantitative assessment	No. The study design pursues a different focus (aim through quantitative approach rather generalisability).
Kranjc Horvat, A. et al. Learning Goals of Professional Development Programs at Science Research Institutions: A Delphi Study with Different Stakeholder Groups.	yes	yes	no. The aim is to identify the most important learning objectives. List of results with evaluation. No process implementation	No, only understand learning objectives, not the process	Yes, comments on expert evaluations are welcome.	Ranking of the results in the final rounds will be made	No. Since the qualitative analysis part offers too little structure for the goal of theory development

Uum, E. M. Behaving entrepreneurially in a digital transformation: A focus group study on entrepreneurial qualities and professional identity of employees in a digital transformation	yes	yes	yes	unclear description	No. No longer at the time of the second round of the Delphi study, since quantitative evaluation and assessment	Ranking of the results in the final rounds will be made	No. Procedure insufficiently described. Feedback and examination of the contents by the experts not given.
Ökmen et al. A needs analysis on the competences that students should have for curriculum and instruction graduate programs: A Delphi study.	yes	yes	no. The aim is only to identify competences. List of results with values. No process implementation	Content analysis can be used in principle. However, the aim is to list the competences for later ranking (in rounds 2 and 3).	No. No longer at the time of the second round of the Delphi study, since quantitative evaluation and assessment	Statistics-based ranking of the results in the final rounds will be done	No. Since the qualitative analysis part does not provide enough structure for the goal of theory development and the knowledge goal of this work goes beyond the

							identification of competences, the qualitative analysis part is not sufficient.
Gajic & Palcic A new framework for complexity analysis in international development projects — Results from a Delphi study	yes	yes	No. Factors are based on literature research and not on information provided by the experts.	No. Only ranking by experts	No. Only ranking by experts	Statistics-based ranking of the results in the final rounds will be done	No. No idea generation by the experts and focus on ranking

Cech & Tellioglu Impact of the Digital Transformation: An Online Real-Time Delphi Study	no. Public comments within the panel	yes — but real time, therefore less flexibility	Focus rather on forecasting and assessing the future	Focus more on forecasting and assessing the future	Yes, comments on expert evaluations are welcome.	Statistical analyses and median values; inductive categorisation of keywords	Real time and no preservation of anonymity are not adaptable for this study
Hodapp et al. Value Co-Creation in Nascent Platform Ecosystems: A Delphi Study in the Context of the Internet of Things	yes	yes	yes (brainstorming phase: experts should name and describe challenges)	No. Only naming and later ranking	No. No longer at the time of the second round of the Delphi study, since quantitative evaluation and assessment	Statistics-based ranking of the results in the final rounds will be done	No. Only summary of mentions and subsequent ranking (no embedding in context or creation of own content categories).

Mthembu et al. Guidelines to integrate spirituality and spiritual care in occupational therapy education: A modified Delphi study	no (second round is a joint workshop)	no (presence workshop)	yes, through exchange in the workshop	No. Naming and clarification to gain clarity on guidelines	Yes, clarifications and comments welcome and possible	Statistics based ranking of the results in the last rounds will be done	No, because a face-to-face workshop is out of the question and at the same time the process implementation is not sufficiently considered
Weibl & Hess Success or failure of big data: Insights of managerial challenges from a technology assimilation perspective.	yes	yes	yes (brainstorming phase: experts should name and describe challenges)	No. Focus more on challenges	No. No longer at the time of the second round of the Delphi study, since quantitative evaluation and assessment	Ranking of the results in the last rounds will be done	No. Only summary of mentions and subsequent ranking (no embedding in context or creation of own content categories).

Hartl & Hess The role of cultural values for digital transformation: Insights from a Delphi study.	yes	yes	yes (brainstorming phase: experts should name and describe challenges)	No. Focus more on challenges	No. No longer at the time of the second round of the Delphi study, since quantitative evaluation and assessment	Ranking of the results in the last rounds will be made	No. Only summary of mentions and subsequent ranking (no embedding in context or creation of own content categories).
White, G. R. Future applications of blockchain in business and management: A Delphi study	yes	yes	yes (brainstorming phase: experts should name and describe cultural values)	No. Focus rather on identifying cultural values	No. No longer at the time of the second round of the Delphi study, since quantitative evaluation and assessment	Ranking of the results in the last rounds will be done	No. Only summary of mentions and subsequent ranking (no embedding in context or creation of own content categories).

Appendix 3.2: Confirmation of Ethical Approval

COLLEGE OF BUSINESS, PSYCHOLOGY & SPORT RESEARCH ETHICS PANEL (CBPS REP)

CONFIRMATION OF APPROVAL

14 September 2021

REP CODE: CBPS20210037-R

IMPLEMENTING A FRAMEWORK OF FUTURE KEY COMPETENCIES FOR DIGITAL TRANSFORMATION IN GERMAN MITTELSTAND

Dear Inga,

Thank you for your application for proportionate review ethical approval to the College of Business, Psychology and Sport Research Ethics Panel on the 10th September 2021.

Your application has been reviewed in accordance with the University of Worcester Ethics Policy and in compliance with the Standard Operating Procedures for proportionate ethical review.

The outcome of the review is that the Panel is now happy to grant this project ethical approval to proceed.

Your research must be undertaken as set out in the approved application for the approval to be valid. You must review your answers to the checklist on an ongoing basis and resubmit for approval where you intend to deviate from the approved research. Any major deviation from the approved application will require a new application for approval.

As part of the University Ethics Policy, the University undertakes an audit of a random sample of approved research. You may be required to complete a questionnaire about your research.

Yours sincerely,

PROFESSOR GYŐZŐ MOLNÁR
Chair – Full Review Panel, College of Business, Psychology and Sport Research Ethics Panel
Chair - College of Business, Psychology and Sport Research Ethics Panel
Ethics@worc.ac.uk

University of Worcester

Version: 1.0

Date: 1st August 2021

PARTICIPANT INFORMATION SHEET AND PRIVACY NOTICE

TITLE OF PROJECT:
Implementing a framework of future key competencies for digital transformation in German Mittelstand

Invitation

The University of Worcester engages in a wide range of research which seeks to provide greater understanding of the world around us, to contribute to improved human health and well-being and to provide answers to social, economic and environmental problems.

We would like to invite you to take part in one of our research projects. Before you decide whether to take part, it is important that you understand why the research is being done, what it will involve for you, what information we will ask from you, and what we will do with that information.

We will in the course of this project be collecting personal information. The UK continues to be bound by the provisions of the General Data Protection Regulation which is now the "UK GDPR" Under UK GDPR we are required to provide a justification (what is called a "legal basis") in order to collect such information. The legal basis for this project is "**task carried out in the public interest**".

You can find out more about our approach to dealing with your personal information at https://www.worcester.ac.uk/informationassurance/visitor-privacy-notice.html.

Please take time to read this document carefully.

What is the purpose of the research?

This study aims to develop a framework of future key competencies for digital transformation in German Mittelstand and to develop practice-oriented approaches for its implementation in organizations.

The increasing use of (intelligent) digital technologies in organisations has a significant impact on both the processes of value creation and on each individual employee. Above all, the changed world of work and the associated new and future requirements for employees in German Mittelstand as well as the search for answers to a practice-oriented implementation are the focus of this research. The gap that is being closed is of great importance both scientifically and practically.

Who is undertaking the research?

Researcher: Inga Knoche, M.Sc. (Doctoral candidate)
Contact address: knoi1_18@uni.worc.ac.uk

Who has oversight of the research?

The research has been approved by the Research Ethics Panel for the College of Business, Psychology and Sport, University of Worcester in line with the University's Research Ethics Policy. The University of Worcester acts as the "Data Controller" for personal data collected through its research projects and is subject to the UK GDPR and the Data Protection Act 2018. We are registered with the Information Commissioner's Office and our Data Protection Officer is Helen Johnstone (infoassurance@worc.ac.uk). For more on our approach to Information Assurance and Security visit: https://www.worcester.ac.uk/informationassurance/index.html.

Why have I been invited to take part?

You have received this invitation because your expertise and experience is considered very valuable for this research. We are hoping to recruit 25-30 participants for this study.

How do I take part?

It is up to you to decide whether or not you want to take part in this study. Please take your time to decide and talk to others about it if you wish. Deciding to take part or not will not impact your reputation or personal and professional relationships.

The process for you to agree to participate is quite simple. If you would like to take part and any questions you may have about the study have been clarified in advance, please reply in the same way you received this information no later than 7 days after receiving, that you would like to take part. You will then receive a consent form.

If you do decide to take part, at the data collection stage, you will be asked to sign this consent form.

How can I withdraw from this study after agreeing to participate?

If you do decide to take part you can withdraw from the study until up to 10 working days after data collection. If you wish to have your data withdrawn please contact us (our contact details are given below). Once the evaluations of one round of the survey have been completed, it will be possible for you to withdraw for future rounds; any data you have provided up to that point that has been processed in the group evaluation cannot be removed at that point as this may affect the usability of the other data.

What will happen if I agree to take part?

- If you have agreed to participate by means of the consent form, you will participate as one of 25-30 experts in an anonymous, written, qualitative survey using the Delphi method.

- Communication around the survey will be done for you throughout the study via email and only in 1:1 exchange with the researcher. There will be no contact between the experts due to anonymity. The submission of the questionnaires themselves and their answers will be done via an online tool called "limesurvey". For this, you will receive the link to the survey on the email you provided. The answers you give will only be accessible to the researcher via the password-protected access to the "limesurvey" service. Your data and the answers you give

are stored on a German server of the provider "limesurvey" in accordance with the applicable GDPR and are protected against unauthorised access.

- You will receive a link to the first questionnaire, with a request to state your perceptions on the questions listed there as accurately and in as much detail as possible, and to write them down in the spaces provided. Please use only the survey you received via the "limesurvey" link for your answers in each round. You have 14 days to complete the questionnaire. You can allow about 45-60 minutes to complete the first questionnaire.

- After all experts have answered the questionnaire completely in the given amount of time, the results will be analysed qualitatively by the researcher. A joint and anonymous group result of the answers from the first round will be the basis for the questionnaire of the second round. For the second round, which will start about 3 weeks after the end of the first round, you will again receive a link to the second questionnaire via "limesurvey".

- Based on the group results, you will be asked to comment on them in the second round. This can include additions or requests for changes or a critical comment on the group result of each question. Again, you have 14 days to answer the questionnaire via the "limesurvey" platform. The time you need to complete the second questionnaire depends on how you perceive the results presented. As the questions are the same, you can expect a shorter (approximately 20-30 minutes) completion time.

- Depending on the results of the group after answering the questionnaire after the second round, the data collection may be completed at that time. If further discussion is identified within the expert group, round two will be repeated in a third round, as described, to achieve saturation of the data.

What are the benefits for me in taking part?

This research is being carried out as part of my Doctorate at the University of Worcester. The results will be published in my dissertation and may also be published in academic journals or at conferences. The research aims to contribute both new knowledge and new contributions to a current practical phenomenon. Your experience

and expertise can make a key contribution to fulfilling this aim and producing a practicable and high quality research outcome.

Are there any risks for me if I take part?

You will receive this information sheet before you can make a decision regarding your participation. You are welcome to ask the researcher any questions you may have in advance. You will find the contact details on the first page of this letter. Once you have made your decision, you will also receive an informed consent form, which you can withdraw even after you have signed it, should you decide to do so. Therefore, by deciding to participate in this study, you do not incur any risk.

You can decide for yourself the exact time and situation in which you want to deal with the questionnaires. Even though the Delphi method is a group discussion process, your anonymity is guaranteed at all times due to the written form in which it is carried out. Due to the communication channels via e-mail and via „limesurvey", it is at no time necessary to have a personal contact in the context of the research, so that against the background of the still ongoing COVID-19 pandemic situation there is no danger for you.

The comments of your perception and expertise are a valuable contribution to my research project. You may feel that you are giving personal and very frank perceptions in the questions and may fear negative repercussions if you answer in detail and critically. For this reason, anonymity and confidentiality are of the utmost importance. Since you can decide yourself when to complete the questionnaire and the answering does not take place in an interview situation, it is rather unlikely that the processing will cause anxiety or stress. If you feel uncomfortable in connection with this survey, you can talk to an independent person who is not a member of the research team. In this case you can contact the Secretary to Research Ethics Panel for College of Business, Psychology and Sport, whose contact details can be found at the end of this information sheet. As the responsible researcher, I will do my best to avoid the risk of negative consequences or psychological stress.

The study focuses on the German Mittelstand and is therefore being conducted outside the UK, so the data protection rules to the UK and Germany will apply.

What will you do with my information?

Your personal data / information will be treated confidentially at all times; that is, it will not be shared with anyone other outside the research team. It will also not be shared with any third parties specified in the consent form unless it has been fully anonymised. The exception to this is where you tell us something that indicates that you or someone else is at risk of harm. In this instance, we may need to share this information with others; however, we would inform you of this and discuss this with you before doing so.

During the project, all data / information will be kept securely in line with the University's Policy for the Effective Management of Research Data and its Information Security Policy.

We will process your personal information for a range of purposes associated with the project primary of which are:

- To use your information along with information gathered from other participants in the research project to seek new knowledge and understanding that can be derived from the information we have gathered.
- To summarise this information in written form for the purposes of dissemination (through research reports, conference papers, journal articles or other publications). Any information disseminated / published will be at a summary level and will be fully anonymised and there will be no way of identifying your individual personal information within the published results.
- To use the summary and conclusions arising from the research project for teaching and further research purposes. Any information used in this way will be at a summary level and will be fully anonymised. There will be no way of identifying your individual personal information from the summary information used in this way.

If you wish to receive a summary of the research findings or to be given access to any of the publications arising from the research, please contact us.

How long will you keep my data for?

Until the end of the project (including the publication deadline).

After completion of the project, we will keep your data only in anonymised form and destroy all data related to the project after a 10-year period.

How can I find out what information you hold about me?

You have certain rights in respect of the personal information the University holds about you. For more information about Individual Rights under GDPR and how you exercise them please visit: https://www.worcester.ac.uk/informationassurance/requests-for-personal-data.html.

What happens next?

Please keep this information sheet

We will wait at least 7 days before asking you to decide whether you would like to take part in the study and will be happy to answer any other questions you may have about the study.

Our contact details are:

If you decide to take part in this project and we hope you would like to do so, or if you have any further questions, please contact:

- Inga Knoche, M.Sc.
  knoi1_18@uni.worc.ac.uk

If you have any concerns about the project at this point or at any later date you may contact the researcher (contact as above) or you may contact the Supervisors:

- Professor John Sparrow
  Johnsparrow2607@gmail.com

- Dr Holly Andrews
  h.andrews@worc.ac.uk

Thank you for taking the time to read this information.

If you would like to speak to an independent person who is not a member of the research team, please contact the University of Worcester, using the following details:

Secretary to Research Ethics Panel for College of Business, Psychology and Sport
University of Worcester
Henwick Grove
Worcester WR2 6AJ
ethics@worc.ac.uk

Appendix 3.4: Informed Consent Form

University of Worcester

INFORMED CONSENT FORM (NON-NHS RESEARCH)

Title of Project: Implementing a framework of future key competencies for digital transformation in German Mittelstand

Researcher: Inga Knoche, M. Sc., Doctoral Candidate – Doctor of Busniess Administration, University of Worcester, Worcester Business School

Contact: knoi1_18@uni.worc.ac.uk

I, the undersigned, confirm that (**please initial boxes as appropriate**):

1.	I have read and understood the information about the project, as provided in the Information Sheet dated _____ or it has been read to me.	
2.	I have been able to ask questions about the project and my participation and my questions have been answered to my satisfaction.	
3.	I am aware that participation in this study involves the written completion online questionnaires, the link to whichwill be sent via email after I have given my consent. My answers will be anonymised and summarised with those of others in a group result. This group result will be sent to me and others in a further questionnaire, as before, for comment. This may be repeated several times. The group results are stored on a secure server for 10 years and then properly destroyed.	
4.	I understand that I may withdraw at any time without giving reasons and that I will not be penalised for my withdrawal nor questioned about the reasons for my withdrawal.	
5.	I understand that if I withdraw from the study, the responses I submit can be removed up to 10 working days after the end of the data collection. After this time, my responses cannot be removed from the group results and will remain in the group results in the anonymous form described, even if I no longer wish to participate in subsequent rounds.	
6.	I am aware that the information I provide will be used for: Articles in professional journals, the researcher's Thesis, for anonymised publication at professional conferences or in online media.	
7.	I agree that my information may be cited in research results in anonymised form.	
8.	I understand that my real name will not be published and pseudonyms will be used for quotes.	
9.	I am aware that participation will be confidential for reasons of data protection and to avoid disadvantages for the participants' careers.	
10.	The procedures regarding confidentiality have been clearly explained (e.g. use of names, pseudonyms, anonymisation of data, etc.) to me.	
11	I understand that personal information collected about me that can identify me, such as my name, or where I live, will not be shared beyond the study team.	
12.	I understand that as an expert within the Delphi study I will receive results from the research process and that I will keep these confidential and not share them with anyone outside this research project.	
13.	I understand that other researchers will only have access to this data if they agree to maintain the confidentiality of the data and if they agree to the conditions I have specified in this form.	
14.	I voluntarily agree to participate in the project.	
15.	I know who to contact if I have any concerns about this research	

Name of Participant	Signature	Date
Name of Researcher	Signature	Date

1

UW Consent Form
Version 2 – 29 April 2021

Chapter 4

Appendix 4.1: Codebook Excerpt Main Category ‘Technology’ - Section 1 – Delphi Round 1

Name	Beschreibung	Datei	Referenzen
1_TECHNOLOGIE	Alle Aspekte, Effekte und Treiber, die genannt wurden von den Experten und die sie erwarten	5	105
Automatisierung		1	7
Einsatz moderne digitaler Technologien		1	36
3 D Druck		1	1
autonomen Fahren		1	1
Big Data		1	5
Cloud		1	6
digitale Integration		1	3
digitaler Zwilling (komplexe Produkte)		1	1
E-Mobilität		1	1

Name	Beschreibung	Datei	Referenzen
KÜnstlicher Intelligenz		1	6
Managed Services		1	1
moderne Assistenzsysteme		1	1
Quantencomputing		1	2
Security		1	1
Systemanbieter		1	2
Telemedizin		1	1
Virtual und Augmented Reality		1	2
Zunehmende Vernetzung		1	2
Technologie	Was wird noch mehr Einzug halten in die Welt der Menschen?	1	13
Big Data		1	1
Bioengineering		1	1
Die Konfigurierbarkeit komplexer Produkte wird zum Standard werden		1	1
Mehr Wissen durch KI		1	1

Name	Beschreibung	Datei	Referenzen
Optimierung von Ressourcen durch KI		1	1
Quantencomputing		1	4
vermehrt Blockchain Technologie		1	1
vernetzte künstliche Intelligenz		1	3
Technologische Aspekte	Was kommt zum Einsatz oder was prägt die Zusammenarbeit technologisch?	1	13
Automatisierung		1	1
Cloud		1	1
digitale Zusammenarbeit		1	6
Geschäftsnetzwerke		1	2
produzierende Bereiche verstärkt digital		1	1
Virtual und Augmented Reality		1	2
Technologische Effekte	Was wird sich durchsetzten, worauf kommt es an?	1	6
Automatisierung		1	2
Cloud		1	1

Name	Beschreibung	Datei	Referenzen
dynamischer		1	1
Innovation		1	1
vernetzte künstliche Intelligenz		1	1
Technologische Treiber	Was wurde hier benannt, das die Prozesse verändert zukünftig?	1	20
Automatisierung		1	15
KÜnstlicher Intelligenz		1	4
Machine Learning		1	1
Zuwachs Nutzung digitaler Technologie		1	10

Appendix 4.2: Codebook Example Question 3a - Section 3 - Delphi Round 1

Name	Description	File	References
10_CURIOSITY		1	3
Curiosity	(Positive) curiosity: Developments will bring about enormous changes in every respect, and coping with them requires recognising these changes at an early stage, assessing their effects and positioning oneself accordingly. For this, a good portion of curiosity in all areas of life is of decisive importance, since in particular the amalgamation of information/knowledge from different areas will only be able to anticipate potential images of the future.	1	2
"Curiosity" as a competence	The last 20 years of disruption and innovation have once again clearly shown that lifelong learning is necessary. We must constantly deal with changing environmental parameters.	1	1
11_COOPERATIVENESS	Cooperation and collaboration, networks and exchange	1	4
Willingness to share knowledge	In the future, there will be neither kingly knowledge nor special competences that only a few have. Knowledge will become broader.	1	1
Ability to cooperate	The skill of working with other people (and systems) towards a common goal. Sharing knowledge, openness and willingness to help are key points here.	1	1
Ability or willingness to cooperate	Cooperativeness/will to cooperate - the ability to work in a division of labour, to invest	1	1

Name	Description	File	References
	in cooperation (willingly provide skills/outcomes in the spirit of the task) and to approach tasks and challenges collaboratively		
Networking	If you are not networked with others, you can neither exchange knowledge and experience, nor win orders or customers, nor use the competences of others quickly. It will become more and more important to spend time outside but also INSIDE the company for networking and relationship building. In addition, appropriate platforms are also needed within the company to facilitate networking and to share knowledge and experience effectively.	1	1
12_MOTIVATION		1	4
Personal initiative	The employee has to take care of his or her own competences to a certain extent. The company is not a guarantor of success and permanence.	1	1
Intrinsic motivation	The motivation to keep experiencing, learning and adapting to new things has to happen from within everyone. An instruction to face these tasks cannot lead to success.	1	1
Performance, willingness		1	1
Motivation		1	1
13_COURAGE		1	2
Courage	You can go new ways and make new decisions every day. The time of procrastinators	1	1

Name	Description	File	References
	and administrators is over.		
Courage to use digital technologies		1	1
14_COMMUNICATION COMPETENCE		1	5
Communication		1	1
Communication and cooperation	Communication / Cooperation - The lone warrior and silo king will disappear. Collaboration becomes important and communication is needed for this	1	1
Communication competence	"You can't not communicate" - clear, appreciative, non-violent communication is an absolute must in a digitally transformed working world.	1	2
Communicate and cooperate	- Being able to communicate using digital tools (being able to operate teams, Zoom and other tools, like a SmartPhone) - Being able to cooperate using digital tools (being able to share content and work together on digital anal)	1	1
15_SELF-ORGANISATION		1	6
Personal responsibility and belief in self-efficacy	Personal responsibility and thus the belief in one's own self-efficacy: More flexible organisational structures and agile working require personal responsibility. However, this will only be sustainable by people if they themselves have a positive expectation of self-efficacy Ability to learn and change: new technologies and changed processes	1	1

Name	Description	File	References
	place high demands on one's own changability. Only those who are willing to constantly learn and develop will be successful.		
Self-organisation	The increase in information and communication requires a high degree of self-discipline and organisation in order to prioritise one's own work.	1	1
Self-discipline	(The quantity and quality of one's own performance must not depend on whether an employee is working in the home office or in the company premises).	1	1
Self-leadership	When everyone is available around the clock, work neither time nor place, a mindful approach to oneself, one's resources and also one's tasks is absolutely necessary.	1	1
Self-organisation skills	Ability to organise oneself - no corset of specifications, but guard rails, independent work in the sense of the task/company	1	1
Independence	(independent working is important in times of remote work, as a colleague is not always available)	1	1
16_ANALYTICAL THINKING		1	3
Ability to analyse	Ability to analyse, understand and master complex systems	1	1
Analytical thinking skills	Processes will become more and more complex. The ability to abstract, dissect, think through and understand them is important	1	1
Search, process, store	- Identify and merge relevant sources - Search in different digital environments -	1	1

Name	Description	File	References
	Analyse, interpret and critically evaluate information and data - Summarise, organise and store information and data in a structured way.		
17_STRATEGIC ORGANISATIONAL UNDERSTANDING		1	8
Business Model Design		1	1
Customer centricity	Customer centricity (not -orientation).	1	2
Bringing employees and leadership along		1	1
Organizational Change Management		1	1
Process design in LowCode ~ No-Code		1	1
Risk management	Assess what risks exist and / or actions entail	1	1
Strategic integration into business objectives	People need to be brought along, communicative onboarding and leadership process with strategic integration into company goals.	1	1
18_CREATIVITY		1	1
19_RESPONSIBILITY	The ability to take responsibility proactively and to stand by this responsibility	1	1
1_OPENESS		1	16

Name	Description	File	References
Acceptance of transparency	Willingness to/acceptance of transparency - digital work environments enable/imply a high degree of transparency that must be accepted	1	1
Mindset	be open to change	1	1
Openness		1	2
Openness to developments and technologies	Technologies change and develop. Every development should be approached with an open mind before judging it too hastily.	1	4
Openness and joy for new things		1	1
Openness_2	The willingness to consider every day as "Day 1	1	1
Open Mind	the competence to work on oneself and to remain open to strong changes	1	1
Positive basic attitude	Being able to let go and be open to new things. A positive basic attitude towards change is needed, everything else can be learned.	1	1
Positive attitude and adaptability	Positive attitude and adaptability towards new technologies (negative attitude inhibits the learning process and the learning speed and hinders satisfaction. Dissatisfied employees drop out more often and make more mistakes).	1	1
Willingness to change	The mindset to seek and steer change and to help shape change, also within oneself.	1	1
Ability to change	The digital working world will be characterised by continuous change (technology, process, organisation); the willingness and ability to not only come to terms with	1	2

Name	Description	File	References
	constant change, but to draw strength, motivation and performance from it, to be able to question one's own actions and to adapt to given requirements (or to influence them) will be a decisive competence for digital, agile companies.		
2_EMPATHY		1	5
emotional intelligence		1	1
Empathy	There is no alternative to personal contact between workers and employers (supervisors). Therefore, when using digital technologies, a maximum level of personal appreciation should be maintained; empathy.	1	3
Ability to work in a team and empathy	Teamwork and empathy towards employees who are not open to all developments of digitalisation. Many employees - especially older colleagues - have acquired important skills in the course of their professional lives that are of use to the company and which must not be dispensed with just because an employee does not want to be fully digitised.	1	1
3_READINESS TO LEARN		1	15
Lifelong learning	The ability to recognise what has been learned as "old" and to engage with new knowledge again and again	1	1
Lifelong Learning_2	There will be no more degrees or they will be irrelevant. It's about lifelong and continuous learning!	1	1

Name	Description	File	References
Lifelong Learning_3	"On the contrary: no matter at which level and in which role, all employees have to learn something new all the time, especially outside their own horizons. Learning only takes place in a much more self-determined, self-directed and on-the-job manner.	1	1
Willingness to learn and further training		1	3
Willingness to learn	Constant change in processes requires learning new methods and specialist content from one's own working environment. Active participation in the digital transformation also requires a willingness to learn.	1	4
Readiness to learn_2	Willingness to learn Knowledge of the global interaction of systems Understanding of systemics and systemic compositions (this is especially important for leaders and managers) ... whoever understands the system can steer it	1	1
Willingness to learn_3	Change takes place much faster. If you don't want to be left behind, you have to stay on the ball	1	1
Ability to learn and adapt	Ability to learn and adapt (be curious, acquire new knowledge, etc.)	1	1
Willingness to learn		1	1
Will to continuously develop his skills	Willingness to continuously develop their skills without wanting to stick to known processes.	1	1

Name	Description	File	References
4_SOCIAL COMPETENCE		1	7
Change management		1	1
Digital social competence	Networking and maintaining contacts is becoming digital - this requires certain skills that still need to be learned	1	1
Conflict skills		1	1
Soft skills		1	1
Social competences		1	2
Social competence	Being able and willing to interact well with people and colleagues in a company or network.	1	1
5_MINDFULNESS		1	2
Mindfulness	Mindfulness: Dynamism, uncertainty, complexity - all this can quickly overwhelm people and lead to negative behaviour patterns. It is therefore important to build up a high level of resilience. This can be achieved through mindfulness in relation to one's own body, thoughts and behaviour.	1	1
Working in uncertainty		1	1
6_SOLVING SKILLS		1	5
Identify technical problems		1	1

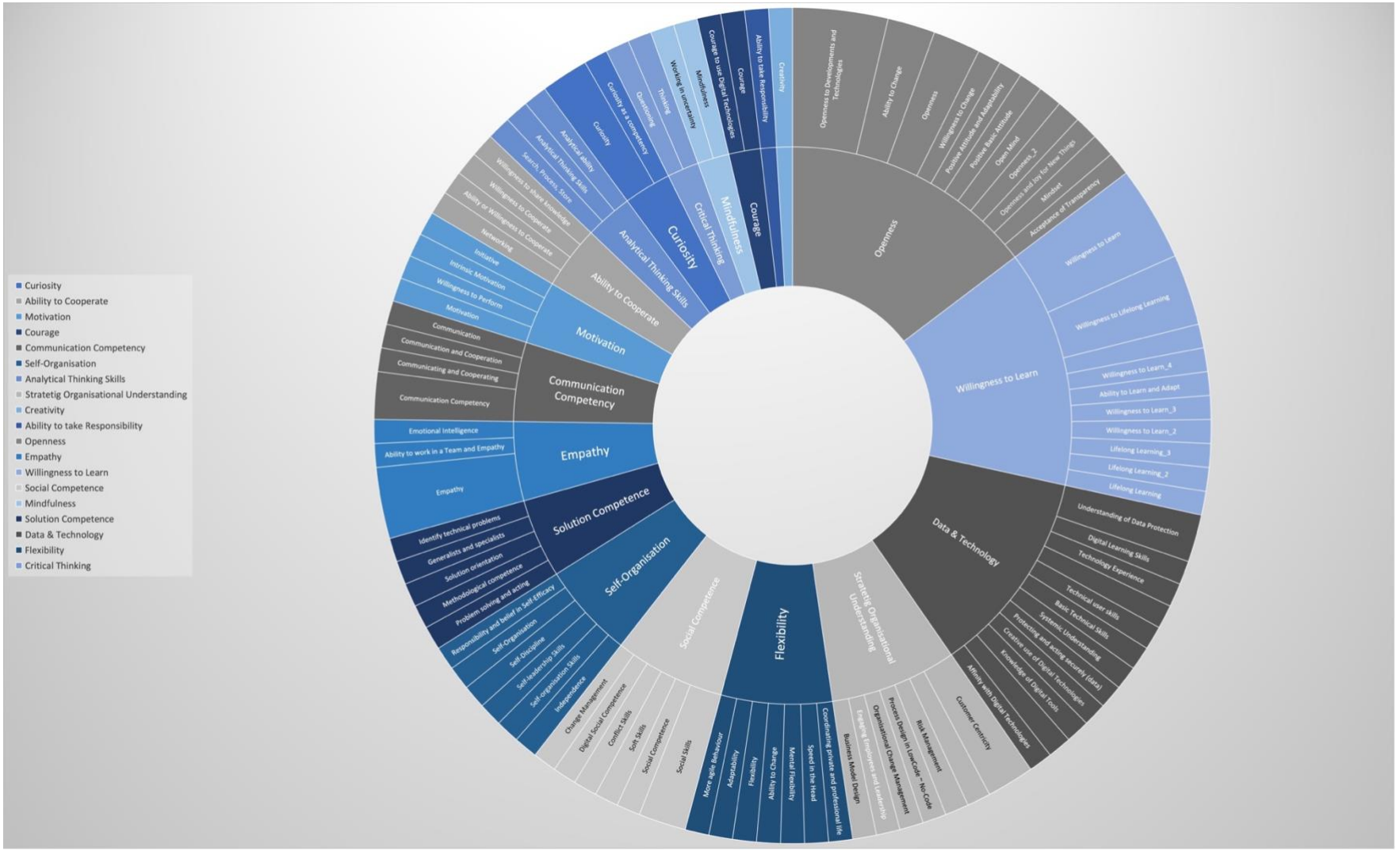
Name	Description	File	References
Generalists and specialists	In addition to the specialists that will be needed for some specialist areas (IT, data analytics...), there will also be a need for generalists who are able to constantly think their way into new topics and link them together in order to create something completely new.	1	1
Solution orientation	Identify needs for solutions and find solutions or develop solution strategies	1	1
Methodological competence	More important than detailed knowledge about something is the competence to approach and implement things, from analytical skills to problem solving / solution orientation.	1	1
Problem solving and action		1	1
7_DATA and TECHNOLOGy		1	13
Affinity for digital technologies	Affinity to digital technologies, interest in the operational processes, in order to also accept and offensively accompany their use and development, not only to use them but to shape them	1	1
Formulate requirements for digital environments		1	1
Knowledge of digital tools	Know a variety of digital tools and use them creatively	1	1
Creative use of digital technologies		1	1

Name	Description	File	References
Protect and act safely (data)	- Know, reflect and consider risks and dangers in digital environments - Consider measures for data security and against data misuse - Constantly update security settings	1	1
Systemic understanding	In my opinion, the third key competence concerns systematisation/archiving when dealing with data, i.e. systemic understanding.	1	1
basic technical knowledge	basic technical knowledge (basic knowledge, because only if I also understand what/how is happening, can I also trust it and also deal with it intensively myself, it is about competences in dealing and with backgrounds, not about superficial knowledge for use)	1	1
Technical user capability	Personal development and lifelong learning are becoming even more important to keep up with ever faster changes.	1	1
Technical understanding of digital technologies	Companies essentially live from process flows. This is where another key competence should lie: technical understanding of digital technology and company-specific application.	1	1
Technology experiences	It will become increasingly important to get to know as many different programmes/applications as possible. Those who can use Slack, for example, will find it easier to find their way around MS Teams and vice versa. Hardly anyone can start from scratch, but those who have a certain basic knowledge will quickly find their way around everywhere because the systems are becoming more and more similar (see, for	1	1

Name	Description	File	References
	example, the similarity between Facebook and LinkedIn).		
Dealing with digital learning opportunities	Finding, evaluating and using effective digital learning opportunities	1	1
Understanding data protection	Understanding data protection, through digitalisation more and more people have access to other people's data. It must be clear to everyone that this data must be handled with trust.	1	2
8_FLEXIBILITY	Flexible and agile action and approach	1	7
more agile approach		1	1
Adaptability	quick adaptability and also the willingness to want to do this	1	1
Flexibility	The willingness to embrace new processes and technologies at any time, i.e. to go along with the transformation.	1	1
Ability to change	the job you originally learned, you probably won't be able to do until you retire.	1	1
Mental flexibility	Directly following on from the previous point - mental flexibility in this context means being open to new things at all times and also drawing on the ideas/opinions/assessments of others, even if they have completely different or contrary opinions.	1	1
Speed in the head	The world and the economy are changing at maximum speed. What is right today can	1	1

Name	Description	File	References
	be wrong tomorrow.		
Coordinate private and professional life	Employees must be able to coordinate family and career even better	1	1
9_CRITICAL THINKING		1	2
Think		1	1
Question		1	1
Competences not universally definable		1	1

Appendix 4.3: Sunburst Diagram - Categories – Section 3a – Delphi Round 1



Appendix 4.4: Complete List of Statements – Delphi Round 2

Statement catalogue - final version incl. templates and settings

Subject: Access data 2nd round of the expert survey - Inga Knoche

Invitation email:

Hello {FIRSTNAME},

we can go on! Herewith you receive the access data for the second round of my survey with the title

{SURVEYNAME}'

'{SURVEYDESCRIPTION}'

To start editing the survey, please click on the following link.
{SURVEYURL}

Please complete the questionnaire in full by **11 March 2022**. As always, earlier **is** also possible☺ . You can expect a processing time of approx. 30 minutes.

As in the first round, you can interrupt the editing and continue later by clicking on "continue later" in the top right navigation and assigning yourself a name and password for later, renewed access. To return to the site, simply click on the access link above. The name and password will only be saved in the system on your participant token and will be deleted directly after you have completed the questionnaire. The name assigned for this can also be an imaginary name.

As announced, this time the processing will be less time-consuming for you. This questionnaire is to be completed mainly by clicking on an assessment field. You can use the free text fields at any time to give me hints, but you do not have to do so in order to complete the questionnaire.

Please contact me at any time if you have any questions or technical difficulties so that I can provide direct support.

But for now, enjoy the group statements of your circle of experts.

Best regards and thank you for your support,

{ADMINNAME} ({ADMINEMAIL})

_____

Kindest regards

Inga Knoche, M. Sc.
- Doctoral Candidate, Doctor of Business Administration -
University of Worcester
Worcester Business School

Mobile: +49 176 64932852
E-mail: knoi1_18@uni.worc.ac.uk

Reminder:

Subject: Friendly Reminder // Participation in the expert survey - Inga Knoche

Hello {FIRSTNAME},

Your answers are very close to my heart for the survey. :)

Therefore, I would like to ask you once again to take the opportunity to participate in the survey.

The title of the survey is

{SURVEYNAME}'

Statement catalogue of the 2nd survey round of the Delphi study within the framework of the dissertation project

"**Implementation of a framework of future key competencies for the digital transformation in German SMEs**

A qualitative Delphi study

To start editing the survey, please click on the following link.

{SURVEYURL}

If you have any questions about this, please contact me directly at {ADMINEMAIL}.

Many thanks and best regards

{ADMINNAME}

Kindest regards

Inga Knoche, M. Sc.

- Doctoral Candidate, Doctor of Business Administration -

University of Worcester

Worcester Business School

Mobile: +49 176 64932852

E-mail: knoi1_18@uni.worc.ac.uk

Confirmation mail:

Subject: Confirmation for participation in the 2nd round of the expert consultation - Inga Knoche

Mail text:

Hello {FIRSTNAME}!

Thank you for taking part in the survey entitled {SURVEYNAME}. I have received your answers and they are now being analysed.

Your contribution is incredibly valuable to my research project and I thank you very much for your input and time.

If you have any questions about it, please contact me directly at {ADMINEMAIL}.

Best regards

{ADMINNAME}

Kindest regards

Inga Knoche, M. Sc.
- Doctoral Candidate, Doctor of Business Administration -
University of Worcester
Worcester Business School

Mobile: +49 176 64932852
E-mail: knoi1_18@uni.worc.ac.uk

Description:

Statement catalogue of the 2nd survey round of the Delphi study within the framework of the dissertation project

"**Implementation of a framework of future key competencies for the digital transformation in German Mittelstand**

A grounded Delphi study

Welcome message:

Hello and welcome to the second round of interviews,

Thank you very much for your willingness to continue supporting me in the context of my dissertation.

The aim of this study is to identify the necessary key competences of employees in German SMEs in a digitally transformed working world in the next 5-15 years and to develop recommendations for action in this area in order to create a framework for German SMEs.

What to do this time?

Please answer the questionnaire completely and do not interrupt the process, otherwise your valuable assessments cannot be taken into account.

You don't have time to answer the questionnaire completely? No problem! You can save the questionnaire and continue later. You will find brief instructions on how to do this in the email with the access link.

In addition to the possibility of leaving notes about your assessment after each section of the questionnaire, there is nothing more to do this time than to rate each statement for yourself on the scale given. Also in this round, the results about the whole group will be used later for further processing in the study results and you and your answers remain completely anonymous.

Let's go!

When assessing the individual statements, please keep in mind the context of the first round of questions and take a few moments to assess each statement individually.

Again, there are no wrong answers. You can give free rein to your ideas and assessments when answering the questions.

Have fun with the editing! ☺

Final message:

You did it! You have reached the end of the questionnaire. ☺

Thank you very much for your valuable input and the time you spent on participation. You are making an important contribution to this research project!

Response options for type "Matrix

- Fully agree
- Rather agree
- I neither agree nor disagree
- Rather disagree
- Do not agree at all

Section 1: Digital transformation - general assessment

In the first round of the survey, this section asked for your assessment of the general changes that can be expected in German Mittelstand in the next few years as a result of the digital transformation. The statements are based on all your answers.

Please rate your assessment of each statement on the scale from "I strongly agree" to "I strongly disagree".
If you have thoughts on individual statements or would like to give me hints, please use the free text field below the category. For better classification of your comments, please indicate the number(s) of the statement(s) (e.g. S-1.3.1).

Forecasts for future developments refer to the period in the next 5-15 years.
Here are the consolidated group statements:

A1K1 (type: matrix)
Category "Technology"

S-1.1.1: Digital technologies will continue to be increasingly integrated into all sectors over the next 5- 15 years, thereby gaining more and more importance and penetration.

S-1.1.2: Through digital technologies, the degree of automation will continue to increase and analogue activities and process steps will be replaced.

S-1.1.3: This development leads to more transparency, efficiency and to leaner, interlinked processes.

S-1.1.4: Technological drivers in the coming years will primarily be artificial intelligence, augmented and virtual reality, cloud computing as well as big data and data analytics.

A1K1Comment (type: long free text)

If you have thoughts or hints about one or more statements in the previous category "Technology", you can leave them here.
Please reference the respective statement number(s) (e.g. S-1.3.8).

A1K2 (Matrix type)

Category "People & Cooperation"

S-1.2.1: The increasing degree of automation will change people's areas of activity, such as the elimination of repetitive tasks.

S-1.2.2: The change in areas of activity brings with it new demands on people.

S-1.2.3: Collaboration will be much more human-centred in the future (5-15 years) due to digital developments.

S-1.2.4: For the expected change to take place, a long-term cultural change and the dismantling of hierarchy must take place.

S-1.2.5: The individual will be given more responsibility and thus working time and place will give way to the work result.

S-1.2.6: For some people, the changes mentioned will not be feasible, so that there will be two extremes in the next 5-15 years. Those who can and want to go new ways and those who stick to previous structures and are overwhelmed with the change.

S-1.2.7: In the future (in 5-15 years), face-to-face events and appointments will primarily take place for team building and relationship building.

S-1.2.8: Due to increasing complexity, interdisciplinary knowledge carriers and specialists will increasingly work together - both internally and externally.

S-1.2.9: Increased virtual collaboration will make work more flexible in the next few years and regionality will become less and less important.

A1K2Comment

If you have thoughts or comments on one or more statements in the previous category "People & Cooperation", you can leave them here. Please reference the statement number(s) (e.g. S-1.3.8).

A1K3

Category "Change"

S-1.3.1: Change in Germany is proceeding too slowly.

S-1.3.2: We are still in the early stages of change through digital technologies in Germany.

S-1.3.3: Different development speeds between digital processes and human processes bring conflict potential and challenges.

S-1.3.4: Perspectively, the speed of change will increase in the next 5-15 years and digital penetration will have reached all levels (entrepreneurial as well as societal), which will amplify the effects described.

A1K3Comment

If you have any thoughts or comments on one or more of the statements in the previous Category "Change", you can leave them here.
Please reference the respective statement number(s) (e.g. S-1.3.8).

A1K4
Category "Company"

S-1.4.1: There will be more automated, standardised business processes that bring cost reduction, productivity increase as well as error minimisation and improvement potential.

S-1.4.2: Products and services are primarily thought of from the benefit of the target group.

S-1.4.3: New (digital) business models are being developed all the time.

S-1.4.4: In the future, the meaning of digital innovations for cultural interaction as well as for working life must be questioned more strongly.

S-1.4.5: Adaptation of technologies and related developments in companies are becoming more dynamic.

A1K4Comment

If you have any thoughts or comments on one or more of the statements in the previous category "Companies", you can leave them here.
Please reference the respective statement number(s) (e.g. S-1.3.8).

A1K5
Category "External company"

S-1.5.1: An increase in automation and artificial intelligence raises the need for action in terms of ethics and morality.

S-1.5.2: The education and social systems must be adapted to the changed circumstances in order to give everyone access to the benefits of digitalisation.

S-1.5.3: Highly networked, digital systems increase security risks through cybercrime and data misuse.

S-1.5.4: Optimal use of resources, thanks to digital technologies, leads to more sustainability.

S-1.5.5: Digital developments will counteract the shortage of skilled workers.

S-1.5.6: Digital developments will at the same time cost jobs, further widening the gap between rich and poor.

S-1.5.7: Digitalisation and technological developments as well as the accompanying changes in the labour market and society require a corresponding political and legal relevance.

A1K5Comment

If you have thoughts or comments on one or more of the statements in the previous category "external to the company", you can leave them here. Please reference the respective statement number(s) (e.g. S-1.3.8).

Section 2: Digital transformation - assessment of companies in the German Mittelstand sector

In the first round of the study, this section asked for your assessment of the changes that are to be expected through the digital transformation for companies in the German Mittelstand sector (especially your own) in the next 5-15 years. The statements are based on the answers of the entire expert panel.

Please rate your assessment of each statement on the scale from "I strongly agree" to "I strongly disagree".
If you have thoughts on individual statements or would like to give me hints, please use the free text field below the category. For better classification of your comments, please indicate the number(s) of the statement(s) (e.g. S-1.3.1).

Forecasts for future developments refer to the period in the next 5-15 years.

Here are the consolidated group statements:

A2K1
Category "Working method"

S-2.1.1: In my company, the digital transformation has already led to process optimisation, automation and thus to more efficient workflows.

S-2.1.2: In our company, there is a desire for more automation and the increased use of data.

S-2.1.3: Due to a high affinity for digital transformation in our management, there is a lot of room for digitalisation projects.

S-2.1.4: The lack of skilled workers is a big driver of digital transformation in my company.

S-2.1.5: Digital technologies have already made our processes leaner, more transparent and more efficient.

S-2.1.6: Flexible and location-independent work has significantly reduced travel time.

S-2.1.7: Thanks to the use of collaboration tools and mobile devices, collaboration and communication has improved for our company.

S-2.1.8: In the future, access to information will become faster and easier.

S-2.1.9: Collaboration will be more barrier-free and increasingly remote (internally and externally).

S-2.1.10: In the future, there will be a dismantling of hierarchical structures.

S-2.1.11: Collaboration will take place in interdisciplinary teams.

S-2.1.12: There will be far fewer offices in the future and work will increasingly be location-independent to a large extent.

A2K1Comment
If you have thoughts or comments on one or more of the statements in the previous "Working methods"category, you can leave them here. Please reference the statement number(s) (e.g. S-1.3.8).

A2K2

Category "Human"

S-2.2.1: Job profiles and activities in our company will change in ways that cannot yet be defined.

S-2.2.2: Many employees in our company do not yet have the skills to prioritise and process the information generated.

S.2.2.3: In my company, the digital transformation has already led to a different culture of togetherness.

S-2.2.4: For employee satisfaction and retention, flexible working with an appropriate culture is important for us.

S-2.2.5: In future, the assessment will be more results-oriented.

S-2.2.6: Due to the increasing level of complexity, the demands on individual services will rise in our company in the future.

S-2.2.7: A higher strength orientation in terms of task distribution will increase, which demands more self-organisation from the people in my company.

S-2.2.8: New skills in people are built up as the demand for qualifications increases.

S-2.2.9: For us, goals are achieved through visions.
S-2.2.10: Responsibility, trust and appreciation will be the core pillars of the future for us.

S-2.2.11: Meeting each other humanely as well as creativity and intuition will become increasingly important for us.

S-2.2.12: The decisive factor for change will always be people, because technology exists but is not an end in itself for us.

A2K2Comment
If you have thoughts or comments on one or more statements in the previous category "Man", you can leave them here. Please reference the statement number(s) (e.g. S-1.3.8).

A2K3
Category "internal company effects"

S-2.3.1: The application of digital communication is a market requirement for us.

S-2.3.2: Digital processes enable us to achieve greater transparency, better clarity and more effective work in projects.

S-2.3.3: We already have many digital channels for faster and more direct communication with our colleagues and our customers.

S-2.3.4: Technological requirements are changing our business model.

S-2.3.5: Digitisation is necessary for us to remain competitive.

S-2.3.6: Through digital opportunities, personnel-intensive services can be scaled better.

S.2.3.7: Future decision-making will be based on artificial intelligence.

S-2.3.8: Language barriers are reduced through simultaneous translation and speech recognition.

S-2.3.9: Artificial intelligence will have an ever greater impact on systems as well as on people.

S.2.3.10: In the next 5-15 years, I do not expect any major leaps in the development of our work processes in our company - based on today's status.

S-2.3.11: A major influence on the digital transformation in our company comes from the available resources - time and money.

S-2.3.12: The investment for digitalisation is extremely high for smaller companies.

S-2.3.13: Our staff must have the time available for digital projects.

S-2.3.14: The long tradition and past successes paralyse rapid changes in our company.

A2K3Comment
If you have thoughts or comments on one or more of the statements in the previous category "internal effects", you can leave them here. Please reference the statement number(s) (e.g. S-1.3.8).

A2K4
Category "external effects & need for action"

S-2.4.1: The prevailing shortage of skilled workers is noticeable for us.

S-2.4.2: To be attractive to potential new employees, digital progress is important to us.

S-2.4.3: When it comes to communication and data exchange, our customers demand an advanced digital transformation of our company.

S-2.4.4: The market pressure is clearly noticeable for us due to (international) competition.

S-2.4.5: The dynamics of the market are shortening the time of our innovation cycles.

S-2.4.6: The current legislation in relation to labour law is at odds with the opportunities of digitalisation that we can use.

S-2.4.7: In the future, the danger of cybercrime will increase for us due to increasing networking.

S-2.4.8: New services and value creation will be required from us due to industries and service fields emerging in the future.

S-2.4.9: Besides digitalisation, sustainability will be a major topic for us.

S-2.4.10: Legal regulations in connection with the digital transformation at global and national level will be a challenge and will also have effects on our company.

S-2.4.11: Evolved structures and bureaucracy slow down digitalisation in our country.

S-2.4.12: The culture in our company is not open enough to drive change as there are some employees who reject change.

S-2.4.13: Leadership plays a central role for change.

A2K4Comment

If you have thoughts or comments on one or more statements in the previous category "external effects & need for action", you can leave them here. Please reference the respective statement number(s) (e.g. S-1.3.8).

Section 3: People in the digital transformation

In the first round of the study, this section asked for your assessment of human skills and competences that will become more important in the context of digital transformation in the next 5-15 years. The statements are based on the responses of the entire expert panel.

Please rate your assessment of each statement on the scale from "I strongly agree" to "I strongly disagree".
If you have thoughts on individual statements or would like to give me hints, please use the free text field below the category. For better classification of your comments, please indicate the number(s) of the statement(s) (e.g. S-1.3.1).

Please consider in the following the forecasts and your corresponding assessments for future developments from the previous sections.

Here are the consolidated group statements:

A3K1
Category "future essential key competences"

S-3.1.1: Curiosity

S-3.1.2: Cooperative work with others

S-3.1.3: Motivation

S-3.1.4: Courage

S-3.1.5: Communication skills

S-3.1.6: Self-organisation

S-3.1.7: Analytical thinking in dealing with information and data

S-3.1.8: Strategic organisational understanding

S-3.1.9: Creativity

S-3.1.10: Willingness to take responsibility

S-3.1.11: Openess to change

S-3.1.12: Empathy

S-3.1.13: Willingness to learn

S-3.1.14: Social competence

S-3.1.15: Mindfulness

S-3.1.16: Problem solving skills

S-3.1.17: Flexibility

S-3.1.18: Technical understanding of digital technologies

S-3.1.19: The ability to question facts critically

A3K1Comment
If you have thoughts or comments on one or more of the statements in the previous category "future essential key competences", you can leave them here. Please reference the statement number(s) (e.g. S-1.3.8).

A3K2
Category "Competencies that promise excellence"

Note: Please understand peak performance in the context of the outlined and for you evaluated situation of a future, digitally transformed working world.

S-3.2.1: Creativity

S-3.2.2: Openness to new things

S-3.2.3: Curiosity

S-3.2.4: Analytical Thinking

S-3.2.5: Organizational Change Management

S-3.2.6: Ability to work in a team

S-3.2.7: Fun

S-3.2.8: Commitment

S-3.2.9: Understanding Technology and Data

S-3.2.10: Ability to work together

S-3.2.11: Willingness to learn

S-3.2.12: Problem Solving Skills

S-3.2.13: Empathy
S-3.2.14: Adaptability

S-3.2.15: Motivation out of oneself

S-3.2.16: Ability to handle knowledge

S-3.2.17: Process understanding

A3K2Comment

If you have thoughts or comments on one or more of the statements in the previous category "Competences that promise excellence", you can leave them here. Please reference the statement number(s) (e.g. S-1.3.8).

Section 4: Recommendations for action

In the first round of the study, this section asked for your assessment of the obstacles as well as the measures to achieve the competences mentioned above. The statements are based on the answers of the entire expert panel.

Please rate your assessment of each statement on the scale from "I strongly agree" to "I strongly disagree".
If you have thoughts on individual statements or would like to give me hints, please use the free text field below the category. For better classification of your comments, please indicate the number(s) of the statement(s) (e.g. S-1.3.1).

Here are the consolidated group statements:

A4K1
Category "Obstacles"

S-4.1.1: Needs-based learning and development opportunities are not available or not known.

S-4.1.2: An analysis or mapping of the status quo of knowledge is missing, so it is often not clear where further development can and should start.

S-4.1.3: If companies do not (want to) recognise that a digitally transformed world of work entails breaking away from "we have always done it this way", these companies will not be able to recruit and retain talent in the future.

S-4.1.4: If those in charge do not act with patience and realism but with pressure, this will lead to defiance and resistance among the employees concerned.

S-4.1.5: An obstacle is the lack of acceptance that personalities react differently to change, which results in little room for the development of soft skills.

S-4.1.6: For some people, too much comfort is prevalent, so that the realisation and the will to work on oneself and to develop oneself do not arise.

S-4.1.7: Framework conditions such as rigid role thinking, a lot of bureaucracy or managers who concentrate on guidelines and control instead of developing potentials are a hindrance.

S-4.1.8: Profit maximisation is placed before investment in staff development.

S-4.1.9: An inhibiting mindset among those in charge is an obstacle to development and change throughout the organisation.

S-4.1.10: People who cling to the status quo, either because they lack the will to change or because they are overwhelmed, will not build up the skills they need in the future.

S-4.1.11: Companies invest too little time in the development of their employees.

S-4.1.12: Lack of willingness to change at all levels (leadership, staff) is a major obstacle.

S-4.1.13: Fears, such as being left behind, making mistakes or fear of the unknown, are obstacles to the development of necessary competences.

S-4.1.14: The teaching of the aforementioned competences is a challenge that concerns society, the education system and companies as a whole and must be addressed as such.

S-4.1.15: Values and performance assessments need to be adapted and reconsidered to the new challenges and changes.

A4K1Comment

If you have thoughts or comments on one or more statements in the previous "Obstacles"category, you can leave them here. Please reference the statement number(s) (e.g. S-1.3.8).

A4K2

Category "Measures & Requirements"

S-4.2.1: Actual analyses and objectives on the development status of employees is a first important step to build competences in a targeted manner.

S-4.2.2: Learning and development opportunities to develop potential should take into account employees' interests and inclinations.

S-4.2.3: Employees must be given the time to try new things and learn through play.

S-4.2.4: The framework for development must be given and firmly established in the company, with associated resources and transparent communication about development potential.

S-4.2.5: Creating the right conditions also involves investments for the company.

S-4.2.6: Development comes on its own when people are given complete freedom to develop.

S-4.2.7: Possibilities of digital transformation must be understood as an opportunity.

S-4.2.8: Leadership should be rethought in companies. Leaders should be role models and above all lead with appreciation.

S-4.2.9: Hierarchical structures should be dismantled and employees strengthened in their self-leadership.

S.4.2.10: Awareness that the world is changing a lot must be present in order to create an understanding of the need for development among people.

S-4.2.11: Encouraging motivation through opportunities for trial and error, a positive culture of making mistakes or other incentives.

S-4.2.12: Clear communication of expected changes, goals and related requirements is an important basis for staff development.

S-4.2.13: The creation of an open mindset, especially at leadership level, is a central aspect of successful digital transformation with all its facets.

A4K2Comment

If you have thoughts or comments on one or more statements in the previous category "Measures & Requirements", you can leave them here. Please reference the respective statement number(s) (e.g. S-1.3.8).

A4K3

Category "Individual contribution"

S-4.3.1: Active involvement through personal initiative and a living feedback culture are important contributions of employees for development.

S-4.3.2: Each individual must have the willingness and the will to develop and change.

S-4.3.3: Self-reflection of each individual will be necessary.

S-4.3.4: The willingness to acquire new knowledge and build up skills in a self-directed and informal way and to renew this continuously is an important prerequisite.

S-4.3.5: The openness to change, in terms of working methods, but also in terms of working together, must be present in each individual.

S-4.3.6: Each individual must take responsibility for himself and his environment, i.e. organise himself and also motivate and discipline himself.

S-4.3.7: The co-creation of each individual will be necessary.

A4K3Comment

If you have thoughts or comments on one or more of the statements in the previous "Individual Contribution" category, you can leave them here. Please reference the statement number(s) (e.g. S-1.3.8).

A4K4

Category "most basic competence"

S-4.4.1: Digital process design

S-4.4.2: Curiosity

S-4.4.3: Openess to change

S-4.4.4: Mindfulness (in relation to oneself)

S-4.4.5: Willingness to change

S-4.4.6: Communication skills

S-4.4.7: Cooperation skills

S-4.4.8: Willingness to learn

S-4.4.9: Be able to assume personal responsibility

S-4.4.10: Self-organisation

S-4.4.11: Humanity

S-4.4.12: Strengthening basic skills (Basics)

S-4.4.13: Courage

S-4.4.14: truly take responsibility

S-4.4.15: Ready for further development

Appendix 4.5: Example LimeSurvey Report – Statement S-1.1.4 - Delphi Round 2

Zusammenfassung für A1K1(S114)[S-1.1.4: Technologische Treiber werden in den nächsten Jahren vor allem Künstliche Intelligenz, Augmented und Virtual Reality, Cloud Computing sowie Big Data und Data Analytics sein.]

Kategorie „Technologie“

Antwort	Anzahl	Prozent
Stimme eher nicht zu (A(-1))	0	0.00%
Stimme gar nicht zu (A(-2))	0	0.00%
Stimme weder zu noch nicht zu (A(0))	3	14.29%
Stimme eher zu (A(1))	6	28.57%
Stimme voll zu (A(2))	12	57.14%
Keine Antwort	0	0.00%
Nicht gezeigt	0	0.00%

Zusammenfassung für A1K1(S114)[S-1.1.4: Technologische Treiber werden in den nächsten Jahren vor allem Künstliche Intelligenz, Augmented und Virtual Reality, Cloud Computing sowie Big Data und Data Analytics sein.]

Kategorie „Technologie“