Management Revue

*Manag. Rev.* **2026**; 37(3): 58245
https://doi.org/10.31083/MRev58245

*Article*

# Social Capital in the Digital Transformation: How Assistance Systems in Production Reshape Communication and Knowledge Transfer

Jonas Maximilian Koch[1,*], Christina Krins[1]

[1]Department of Engineering and Management, South Westphalia University of Applied Sciences, 59872 Meschede, North Rhine-Westphalia, Germany
*Correspondence: koch.jonasmaximilian@fh-swf.de (Jonas Maximilian Koch)

Academic Editors: Stefan Süß and Simon Jebsen
Submitted: 20 February 2025 Revised: 12 September 2025 Accepted: 15 September 2025 Published: 21 September 2026

**Abstract**

This study explores how digital assistance systems affect social networks and communication in industrial organisations. Based on an embedded single-case study of two production units, qualitative interviews and network mapping were used to examine changes in workplace interaction. The findings show two main effects: greater informational autonomy reduces informal contact, especially with supervisors, while experiential knowledge loses importance relative to system-based expertise. These developments reshape the structural, relational, and cognitive dimensions of social capital. Linking socio-technical systems theory with social capital theory and Coleman's macro–micro–macro model, the study highlights how digital technologies alter cooperation patterns and informal knowledge flows within production environments.

**Keywords:** assistance systems; organisational social capital; socio-technical system theory; knowledge transfer; digitalisation
**JEL:** L23, M54, D85, O34, O33, M14

## 1. Introduction

Driven by the economic success of tech giants from Silicon Valley, the German government launched the "Industry 4.0" initiative in 2011. Its aim was to enhance the flexibility, agility, and innovativeness of German industry. A central objective of this high-tech strategy is the integration of value creation networks through digital platforms and assistance systems (Bauernhansl et al., 2014; Kagermann et al., 2013). While the digital transformation has already restructured private life, public administration, and the service sector, its impact on industrial shop floors is still unfolding and remains analytically underexplored.

The idea of "workerless factories", predicted in early Industry 4.0 visions, has not materialised (Syska and Lièvre, 2016). Production continues to depend on human labour, especially in skilled manual assembly. At the same time, digital assistance systems—technologies that provide cognitive, sensory, or physical support to workers—have increasingly gained traction in manufacturing contexts (Apt et al., 2018; Niehaus, 2017). These systems guide employees through the assembly process by displaying instructions, signalling errors, or structuring work routines, often in real-time and with limited need for verbal coordination.

In light of this development, research has begun to address how digitally structured work processes affect not only efficiency but also the social dynamics among employees. Early insights suggest that digital assistance systems can restrict spontaneous interaction and reduce informal exchange, especially when standardised, automated feedback replaces interpersonal clarification (Hirsch-Kreinsen and ten Hompel, 2017; Niehaus, 2017). Such effects could alter how knowledge is shared and how trust is built on the shop floor. Warnhoff and de Paiva Lareiro (2019) have shown that digitally mediated work environments tend to limit informal learning—especially when they are embedded in hierarchical work settings with low autonomy. These findings raise broader questions about how new digital infrastructures affect not only skills and learning opportunities but also interpersonal relationships and collective knowledge practices. Against this background, this paper investigates the following research question:

**"How do digital assistance systems affect social relationships and communication structures in industrial organisations?"**

This research question is addressed through a qualitative case study grounded in the socio-technical systems tradition (Trist and Bamforth, 1951). The study focuses on digital assistance systems in industrial production, particularly their influence on work-related communication and collegial relationships. By focusing on shop floor interactions, the study adds to an emerging strand of research that examines how digitalisation restructures informal communication and interpersonal coordination in industrial contexts. Specifically, the study examines whether assistance systems alter the frequency and quality aspects of interpersonal contact—e.g., by reducing opportunities for spontaneous coordination or by shifting communication toward task-related, standardised formats. These aspects are analytically framed through the lens of social capital, understood as a multidimensional construct that captures structural connections, relational trust, and shared cognitive frameworks (Adler and Kwon, 2002; Nahapiet and

Ghoshal, 1998; Portes, 1998). Beyond its conceptual openness and interdisciplinary roots, the concept of social capital is particularly relevant in organisational contexts because it links the quality of social relationships to productivity, cooperation, and knowledge diffusion (Adler and Kwon, 2002; Jans, 2011; Leana and van Buren, 1999; Nahapiet and Ghoshal, 1998). To examine these processes, the study applies a theoretical model that combines the socio-technical systems approach, the concept of social capital, and Coleman's (1988, 1991) macro-micro-macro model. This integrated perspective enables the analysis of how digitally induced changes in communication affect individual behavior and how such behavioral shifts may cumulatively transform organisational interaction structures.

## 2. Application of the Socio-Technical Approach to Digital Assistance Systems

The socio-technical approach emphasizes the mutual influence and interdependence of technical and social subsystems within organisations. Originally developed at the Tavistock Institute (Trist and Bamforth, 1951), it demonstrated that technological changes can profoundly affect not only work processes but also social relationships. In this understanding, technical innovations do not merely have material effects, but also produce unexpected repercussions for communication, coordination, and social interaction (Ropohl, 2009; Sydow, 1985; Ulich, 2013).

With the ongoing digitalisation of work, not only channels of communication but also the fundamental structures of work activity are undergoing change. Digital assistance systems have the potential to intervene in existing work processes: they standardise procedures, automate decision-making, and shift responsibilities (Apt et al., 2018; Niehaus, 2017). This results in a reconfiguration of the socio-technical action system, in which the relationships between people, tasks, and technology must be recalibrated (Ropohl, 2009; Ulich, 2020). The transformation affects both the organisational division of labour and social interaction—for instance, by replacing informal coordination with system-controlled processes or formalised knowledge that was previously shared personally. From this, three fundamental principles emerge that are particularly relevant for analysing digital assistance systems in production environments:

First, digital assistance systems lead to structural changes in work systems. They alter how tasks are sequenced, distributed, and monitored. This entails a reorganisation of communication and decision-making pathways, which also impacts social dynamics—for example, by eliminating informal agreements or changing role relationships (Hirsch-Kreinsen, 2014, 2015; Winby and Mohrman, 2018). Second, assistance systems can function as a medium of social interaction. By providing information, preparing decisions, and structuring feedback processes, they influence how and to what extent employees communicate with one another. Personal interactions are partially replaced or overlaid by technical interfaces (Orlikowski, 2007; Rice and Leonardi, 2014), in which technologies not only transmit communication but also structure and shape it. As a result, the conditions under which trust is built, support is offered, or knowledge is shared are changing (Meissner, 2009; Orlikowski, 2007). Third, informal coordination may be substituted. Practices previously shaped by informal knowledge, collective experience, or situational negotiation are increasingly replaced by systematic, technology-supported procedures. This is particularly evident in processes such as onboarding, knowledge transfer, or spontaneous problem-solving—contexts that are central to informal learning and peer support (Krackhardt and Hanson, 1993; Nonaka and Takeuchi, 2012; Wenger-Trayner, 2005). These developments are closely linked to the question of the extent to which technology-mediated forms of work displace spontaneous coordination practices or channel them into new formalized pathways.

## 3. Social Capital as the Genesis of Collegial Interaction

Social capital is understood across various scientific traditions as a resource embedded in social relationships. Despite differing emphases—such as Bourdieu's (1983) focus on power positioning, Coleman's (1988) emphasis on social obligations and norms, or Putnam's (2001a) concern with social cohesion—there is broad consensus that social relationships serve a productive function that goes beyond mere interaction. In organisational contexts, this function becomes particularly evident in access to information, the mediation of trust, and the facilitation of coordinated action (Adler and Kwon, 2002; Leana and van Buren, 1999; Matiaske, 1999). At the same time, the social capital discourse repeatedly emphasizes that social capital may also have dysfunctional aspects—such as mechanisms of exclusion, pressure to conform, or the reproduction of informal power structures (Bourdieu, 1983; Portes, 1998).

This study adopts the concept of Nahapiet and Ghoshal (1998) as its central theoretical reference, as it is explicitly tailored to organisational contexts and highlights the significance of social relationships for knowledge creation and exchange in firms. In contrast to classical sociological approaches such as that of Coleman (1988), who conceives of social capital primarily as a mechanism of social control and obligation, the approach of Nahapiet and Ghoshal (1998) offers an integrative framework that connects structural, relational, and cognitive aspects of social interaction. This tripartite model enables a differentiated analysis of the interplay between digital technologies and patterns of social relationships in workplace settings. The authors distinguish three analytically separable, yet closely interrelated, dimensions of social capital: The *structural dimension* describes the extent and configuration of social

networks—i.e., who communicates and collaborates with whom, and how regularly. It influences how information is distributed and how quickly it is passed on. From an empirical perspective, this dimension becomes visible in changes to the frequency, reach, and density of social ties—for example, through the elimination of spontaneous coordination or informal queries. The relational dimension focuses on the quality of relationships within these networks. Trust, mutual obligations, and collegial support are key elements that determine how openly and reliably information is shared. Changes in this dimension become evident in statements about missing feedback, social distance, or the loss of trusted contacts. The cognitive dimension, finally, refers to shared meanings, a common language, and collective goals. In this study, it is reflected in statements concerning implicit modes of understanding, the transmission of experiential knowledge, or misunderstandings in dealing with new system logics.

The social capital discourse also distinguishes between different units of analysis: Individual social capital refers to an actor's access to resources through personal relationships (Coleman, 1988; Lin, 2001). It is thus distinct from human capital, which is based on individual abilities, knowledge, and competencies. Coleman (1988, 1991) emphasizes this distinction and stresses that social capital is not rooted in the individual per se but in the structure of their social relationships, while organisational social capital is regarded as an emergent property of collective structures (Adler and Kwon, 2002; Leana and van Buren, 1999; Nahapiet and Ghoshal, 1998). This study focuses on social practices of individual employees. The analysis is based on a micro-level approach, as laid out in Coleman's (1991) macro–micro–macro model: according to this view, collective organisational phenomena can be explained through the interplay of individual actions and relationship patterns. Aggregation—such as through condensed patterns of interaction or shared interpretive frameworks—is thus not merely assumed but is analytically modelled as a theory-driven bridge between the micro and macro levels. This micro–macro linkage is understood in the sense of Coleman (1991) as a theoretically grounded bridge: the model enables a systematic connection of qualitative findings on individual behavior and relational dynamics with collective structures, allowing for inferences about organisational change.

The study thus focuses on changes in these three dimensions of social capital in the context of digital assistance systems. The underlying assumption is that such technologies not only structure work processes but also have an impact on informal channels of communication, collegial support, and shared experiential knowledge. This connection forms the theoretical foundation for the subsequent empirical analysis.

## 4. Derivation of the Propositions

The theoretical framework of this study is based on three complementary approaches: the socio-technical systems approach, which describes the interplay between technical systems and social practices in work environments, serves to capture technology-induced structural changes in organisations.

The concept of social capital provides an analytical framework to examine the structure, quality, and interpretive alignment of social relationships—reflecting their structural, relational, and cognitive dimensions—and their impact on knowledge exchange and cooperation.

Coleman's (1991) theory of action integrates these two perspectives within a macro–micro–macro model. It allows for the theoretical conceptualisation of how technical structuring affects individual actions and how such actions can result in collective effects. Societal conditions—such as the introduction of digital assistance systems—alter individual opportunity sets, which in turn shape social action. The cumulative impact of such actions can lead to the emergence of new organisational structures. The aim of this theoretical integration is to explain how digital assistance systems transform social interaction and how these changes affect the dimensions of social capital. While the study does not empirically capture organisational-level outcomes, it draws on theoretical models to infer potential consequences for the reproduction and configuration of organisational social capital. Coleman's model is applied here, not uncritically. Rooted in rational choice theory, Coleman's model assumes that human action is goal-directed and utility-driven. His original notion of action is, however, narrowly defined: it largely focuses on instrumental behavior aimed at maximising individual benefit and pays limited attention to affective or altruistic motives. This study therefore follows extended approaches to rational choice theory as formulated by Opp (2020) or Esser (1999, 2015). These approaches broaden the concept of rationality to include actions that may not appear immediately rational from a third-party perspective but are subjectively meaningful and purposeful to the actors themselves. Action is thus understood as a socially embedded process that takes into account interpretive frameworks, situational contexts, and symbolic meanings (Esser, 1999; Lin, 2001).

This extended perspective enables us to interpret qualitative interview data not just as reflections of individual behavior, but as manifestations of evolving social practices embedded in structured action systems. In this sense, digital assistance systems are understood not merely as technical artefacts, but as interventions that reshape the conditions and meaning structures of organisational action—with potential implications for the reproduction of social capital.

Following Nahapiet and Ghoshal (1998), this study conceives of social capital not as a static stock but as an emergent resource resulting from the structure, quality, and shared interpretive frameworks of social interactions within

an organisation. Technologically induced shifts in interaction patterns can therefore affect the conditions for reproducing organisational social capital. Based on these theoretical perspectives, specific expectations can be formulated regarding how digital assistance systems may influence the three dimensions of social capital.

The structural dimension pertains to the density, reach, and frequency of social contacts within an organisational network. Digital assistance systems intervene in existing communication processes by providing standardised procedures, visual work instructions, or automated feedback via digital devices. Typical features include touchscreen interfaces at workstations, sensor-based inspection points, or workflow-driven task approvals. These functionalities enable a higher degree of individualized information delivery while reducing the need for spontaneous collegial coordination. As a result, the number of interpersonal touchpoints may decrease, weakening the structural integration of the social network. From a socio-technical perspective, digital assistance systems intervene in existing communication and coordination processes. They provide structured information through digital interfaces—for example, via touchscreens, pick-by-light systems, or automated feedback mechanisms. Consequently, employees rely less on direct interactions with colleagues to clarify tasks or retrieve information. Spontaneous inquiries, situational consultations, or informal coordination increasingly give way to system-based information flows. While the primary effect concerns the structural dimension of social capital, reduced contact frequency also limits opportunities to build and sustain trust, mutual support or reciprocity. These elements belong to the relational dimension and are likewise affected by the digitally mediated restructuring of workplace interactions (Nahapiet and Ghoshal, 1998). When personal interactions are reduced, the number of contact points could diminish, leading to a decrease in network density (Coleman, 1988; Lin, 2001). The social connections through which information, support, and trust are conveyed are activated less frequently—or may not develop at all. Such a decline in informal contact opportunities may have negative consequences for organisational coordination and cooperation. Coleman (1988) notes that dense networks foster trust and serve as channels for information. Conversely, reduced network density hampers spontaneous coordination, mutual support, and shared responsibility. Trist and Bamforth (1951) already observed in early studies that technological rationalization can lead to social fragmentation. The first proposition is therefore:

*Proposition 1: Reduction of Social Interactions*

The use of digital assistance systems reduces the frequency of direct interactions between employees, as many tasks and pieces of information are processed and provided digitally. A decline in contact frequency may lead to weaker social ties and a lower density of social networks.

Digital assistance systems not only alter the structural connections between employees but also affect the quality and content of their interactions. From a socio-technical perspective, technical structuring—such as standardised instructions, automated feedback mechanisms, or digitally mediated information flows—shifts interaction from personal to task-focused communication. This particularly impacts exchange formats through which knowledge was informally transmitted. Experiential knowledge—previously conveyed through collegial conversations, observational learning, or casual coordination—loses relevance when critical work-related information is delivered exclusively through system-based channels. This primarily affects the relational dimension of social capital, in which trust, mutual obligation, and emotional ties play a central role in enabling cooperation. At the same time, the cognitive dimension is implicated, where shared interpretive frameworks, a common language, and cultural alignment are crucial for smooth communication and knowledge sharing (Nahapiet and Ghoshal, 1998). If such informal contexts disappear or are pushed aside, opportunities for generating shared experiential knowledge are lost. As a result, trust relationships are established less frequently, emotional connection diminishes, and collective interpretive patterns begin to erode. Consequently, the organisation's ability to integrate knowledge in a context-sensitive manner and to enable collective learning is reduced. Therefore, the second proposition is:

*Proposition 2: Decline in the Importance of Experiential Knowledge*

The use of digital assistance systems leads to a decline in the significance of traditional experiential knowledge, which is often transmitted informally and personally. The digital provision of information reduces personal, informal knowledge exchange. As a result, experienced employees assume a progressively marginalised role in knowledge-sharing processes.

## 5. Methodology

### *5.1 Empirical Assessment of Social Capital*

Measuring social capital presents a methodological challenge, as it is a multifaceted concept encompassing structural, relational, and cognitive dimensions (Dudwick et al., 2006; Grootaert et al., 2004; Putnam, 2001b). The structural dimension, which describes network connections, density, and positions, is primarily assessed using quantitative approaches. Network analyses enable the visualisation of social structures and the identification of key actors or "bridge-builders" within a network (Burt, 2000; Jansen, 2006). Ego-centred network maps provide a detailed analysis of individuals' direct connections and evaluate their access to resources within the network (Hollstein and Pfeffer, 2010). The relational dimension, which includes trust, norms, and social bonds, is often examined using qualitative methods. Similarly, the cognitive dimension—

encompassing shared language, narratives, and collective interpretive frameworks—lends itself to qualitative investigation, particularly through interview-based insights into meaning-making and understanding. Interviews and narrative approaches are particularly suitable for capturing the affective and emotional aspects of relationships, which are frequently overlooked in quantitative studies (Dudwick et al., 2006; Hollstein, 2006; Reinbacher, 2017). A combined approach that integrates qualitative and quantitative methods offers a more comprehensive analysis of social capital and its impact on organisations. As this case study focuses specifically on cognitive and relational components of social capital, a qualitative approach was chosen and supplemented with quantitative elements. This allows for a detailed examination of social processes and changes resulting from the use of digital assistance systems. The study follows Yin's (2014) case study methodology as its methodological foundation.

### *5.2 Specification of the Case Study*

This study is based on the case study methodology outlined by Yin (2014). Case studies are particularly well suited for analysing complex social interactions and generating generalisable insights. A key strength of Yin's approach lies in its openness to method integration: qualitative and quantitative elements can be meaningfully combined within a single design (Yin, 2014). The present study follows an embedded single-case design, with two assembly departments of a company serving as sub-cases. This flexibility made it possible to combine semi-structured interviews with network mapping, allowing for a multi-perspective analysis of interaction patterns. This design enables an in-depth analysis of the effects of a digital assistance system on social capital in organisations while considering two distinct work system structures. In Department A, the assistance system had already been implemented, allowing for the collection of retrospective data on long-term effects. The assembly process in this department is characterised by standardised procedures. In contrast, data collection in Department B took place during the system's rollout, enabling a comparative before-and-after analysis based on current experiences. This facilitated a before-and-after comparison of its effects. While the assistance system is identical in both departments, it includes department-specific adaptations tailored to their respective production requirements. This research setting is particularly valuable as it allows for an analysis of both long-term and short-term effects of the system's implementation while taking into account different organisational conditions.

The examined digital assistance system supports employees in assembly processes by aiming to enhance efficiency and improve quality assurance. It provides structured and standardised work instructions via an interactive display, allowing employees to access relevant information at any time. Additionally, the system integrates automated verification processes by recording work steps and providing immediate feedback on correct or incorrect assembly actions. Through visual aids such as exploded-view diagrams and step-by-step instructions, complex assembly processes are presented more clearly, reducing the likelihood of errors. Moreover, the system contributes to data-driven process optimisation by collecting production data and identifying potential sources of errors or bottlenecks at an early stage.

### *5.3 Data Collection*

Data collection combined semi-structured interviews with network mapping. The network map was not used to generate formal quantitative measures but served as a visual and interactive tool during the interviews. It enabled participants to spatially represent their work-related social contacts and reflect on structural aspects of their interaction patterns. This facilitated deeper discussions about changes in communication, support structures, and knowledge exchange. While the primary function of the map was qualitative stimulation, the representation of contact constellations also allowed for tentative inferences about network characteristics such as range or density. Rather than aiming for generalisability, the study focused on contextual validity and an in-depth understanding of how assistance systems affect different dimensions of social capital within the case setting.

#### 5.3.1 Semi-Structured Interviews

The development of the interview guide was based on the three-dimensional conceptualisation of social capital by Nahapiet and Ghoshal (1998). The aim was to enable a theory-informed yet empirically open exploration of relevant relational patterns through open-ended, semi-structured questions. The interviews were deliberately conducted in a flexible manner to ensure situational responsiveness and to allow for the exploratory inclusion of emergent insights (Yin, 2014). The structural dimension was operationalized through the mapping of exchange relationships using a network chart, as well as through questions about contact frequency and reach. The relational dimension was addressed through questions on mutual support and the affective conditions necessary for the transfer of experiential knowledge (e.g., "Do you think that your personal relationships with colleagues helped you benefit from this experiential knowledge?"). The cognitive dimension was captured through questions on onboarding, changes in the transfer of tacit knowledge, and forms of understanding within work processes.

A total of 32 interviews were conducted across both departments, comprising 31 interviews with employees and one interview with the project manager. The interviews lasted between 15 and 60 minutes. In Department A, the assistance system had already been in place for over a year at the time of data collection. Consequently, inter-

**Table 1. Overview of interviews by department, function, and system implementation phase.**

| Assembly unit | Implementation phase | Function | Interview codes | Number of interviews |
|---|---|---|---|---|
| A | Implemented (retrospective assessment) | Group leader | GA01–GA03 | 3 |
| | | Expert | EA01–EA06 | 6 |
| | | Assembly worker | AA01 | 1 |
| B | Before implementation | Technician | TB01–TB02 | 2 |
| | | Assembly worker | AB01–AB10 | 10 |
| B | After implementation | Technician | TB201 | 1 |
| | | Assembly worker | AB201–AB208 | 8 |
| Project leader | | | PL | 1 |
| Total | | | | 32 |

Note: GA, group leader assembly unit A; EA, expert assembly unit A; AA, assembly worker assembly unit A; TB, technician assembly unit B; AB, assembly worker assembly unit B; PL, project leader.

views in this unit adopted a retrospective perspective, allowing participants to reflect on changes in communication and knowledge practices before and after implementation. In contrast, Department B was during the system's rollout, enabling a comparative before-and-after analysis based on current experiences. In Department A, particular attention was given to interviewing employees in expert functions. These individuals are formally designated as highly experienced assemblers who serve as direct contacts at their respective workstations and operate between standard assembly workers and line technicians. Their dual perspective—having worked both before and after the system introduction—offered particularly nuanced insights into changes in communication dynamics and knowledge-sharing practices. Department B still operated under a more traditional structure without such intermediary roles. Table 1 provides an overview of the interview participants by function and time of data collection:

This sampling logic is based on the idea that different stages of system implementation can offer complementary insights: while retrospective interviews enable rich narrative reconstructions of change (Flick, 2025), interviews conducted before and after the implementation allow for a comparative, longitudinal perspective on evolving effects (Elliott, 2005; Yin, 2014). The combination strengthens contextual validity and enhances the depth of interpretation.

### 5.3.2 Network Mapping

As part of the semi-structured interviews, a network map was used in all interviews as a complementary methodological element. It was deliberately applied with a dual function: on the one hand, it enabled the visualization of potential changes in the composition and structure of social relationships before and after the introduction of the assistance system. On the other hand, from the outset, it served as a narrative-reflective tool for uncovering subjective meanings of relationships, experiences of change, and interpretive patterns (Hollstein and Pfeffer, 2010). Participants were asked to position key contacts from their work environment spatially around the self—freely and associatively, without predetermined categories. To support this process, participants used small Lego figures and post-its to represent relevant individuals from their work environment. These were placed on a blank sheet of paper, allowing participants to spatially arrange their contact network. Frequently contacted or closely connected individuals were placed nearer to the self, while more peripheral contacts were positioned farther away. This spatial layout then served as the starting point for narrative elaboration and interpretive reflection. The maps were then used as a starting point for open follow-up questions, such as: "Who do you collaborate with differently today compared to the past?" or "Which contacts do you miss in your daily work now?" This approach meant that the map was not used as a standardised measurement tool but rather as a stimulus for reflexive self-positioning within the social system. Although it was initially considered to use the maps for quantitative comparative analyses—for instance, to examine changes in network density or key actors—a systematic evaluation in this sense proved to be methodologically untenable. The individual maps exhibited high formal and content-related heterogeneity, and confounding factors such as shift changes, personnel turnover, or organisational restructuring prevented the isolated attribution of observable differences to the assistance system. Against this background, the methodological use of the network maps focused on their qualitative analytical value. They were integrated into the interview analysis and contributed to making implicit relational experiences and social shifts visible and discussable. Their value thus lay in stimulating narration, clarifying relationships, and revealing latent attributions of relevance—in line with the interpretive approach of reflexive network analysis.

### 5.3.3 Data Analysis

The interview data were analysed using thematic analysis (TA), a flexible method for systematically identifying and interpreting patterns of meaning in qualitative data

(Braun and Clarke, 2006; Kiger and Varpio, 2020). TA was selected as it enables the exploration of both theory-informed and context-specific meaning patterns and is particularly useful for examining processes of communication and knowledge transfer in organisations (Lochmiller, 2021). The analysis followed Braun and Clarke's (2006) six-phase framework, adapted in a reflexive and theory-informed manner. This approach aligns with current best practices in applied thematic research (Kiger and Varpio, 2020).

Phase 1 – *Familiarization With the Data*: The interviews were transcribed automatically and subsequently reviewed manually. During this initial phase, memos were written to capture first impressions and recurring motifs, such as the role of collegial sympathy in knowledge exchange or the transformation of informal coordination. This familiarization process is considered essential in reflexive TA to develop a deep understanding of both explicit and implicit meaning structures (Braun and Clarke, 2006; Lochmiller, 2021).

Phase 2 – *Generating Initial Codes*: Open coding was conducted in MAXQDA Analytics Pro 24.11.1 (VERBI GmbH, Berlin, Germany). In line with Braun and Clarke (2006), both semantic and latent codes were applied. The coding process was hybrid: while some initial categories were informed by the interview guide and the theoretical framework (e.g., trust, social ties, experience-based knowledge), the analysis remained open to unexpected or emergent content. This form of theoretically sensitive but data-driven coding is widely accepted in applied TA (Guest et al., 2011; Kiger and Varpio, 2020).

Phase 3 – *Developing Themes*: To organize the growing number of codes, clustering and visual mapping tools in MAXQDA (MaxMaps) were used. This step corresponds with Braun and Clarke's (2006) recommendation to analyse codes relationally and to search for overarching semantic and conceptual patterns. In reflexive thematic analysis, themes are not predefined categories, but interpretative patterns of meaning that are constructed through the researcher's engagement with the data. A theme captures a central organizing concept that reflects shared meanings across a data set. One example is the theme of data-driven knowledge displacement, which emerged from piecing together statements from various interviewees into a coherent meaning trajectory. Such latent meaning construction reflects a central feature of reflexive thematic analysis (Braun and Clarke, 2006; Clarke and Braun, 2017).

Phase 4 – *Reviewing Themes*: In accordance with Braun and Clarke's (2006) recommendations, candidate themes were systematically reviewed against both their coded content and the entire data set. During this phase, codes were merged, reassigned, or dropped. Some preliminary assumptions—such as the presumed negative impact of reduced face-to-face contact—were reconsidered in light of findings that interviewees perceived such reductions as helpful, e.g., due to fewer disruptive interruptions. These contrasting cases enriched the analytic depth of the themes.

Phase 5 – *Defining and Naming Themes*: Theme labels were carefully crafted to reflect interpretative meaning, rather than merely summarizing topic areas. This aligns with the understanding of themes in reflexive TA as constructed and context-sensitive analytical units (Braun and Clarke, 2006; Kiger and Varpio, 2020). Themes such as reduced contact as relief or data-driven knowledge displacement exemplify this principle. The connection to the dimensions of social capital (structural, relational, cognitive) as defined by Nahapiet and Ghoshal (1998) was established after the core meaning of each theme was consolidated. In many cases, multiple dimensions were interwoven, which reflects the interdependent nature of these constructs.

Phase 6 - *Reporting and Theorizing*: The presentation of findings is structured thematically. A case-based structure (e.g., by department or hierarchy level) was not initially applied, as the themes transcended these categories. To ensure traceability while maintaining anonymity, quotations were attributed using role and context labels (e.g., "assembler, department A"). Theoretical interpretation is primarily addressed in the discussion section, following Braun and Clarke's (2013) guidance to first let participant voices unfold before embedding them in theoretical discourse.

## 6. Results

The following section presents the main empirical findings from the case study. It is divided into two parts: First, the relevance of social capital in the studied departments is outlined to contextualize the analysis. Second, two themes are presented that were derived using reflexive thematic analysis and capture key shifts in work-related social relations under digital assistance conditions.

### *6.1 Relevance of Social Capital in the Investigated Case*

The analysis of the interviews highlights that social capital plays a central role in the daily work of the respondents. Trust, mutual support, and informal knowledge exchange were particularly emphasised as essential for both effectiveness and workplace atmosphere. However, the specific importance of these factors varies depending on the respondent's personality and professional role. One participant explained:

> EA06: "For me, the primary focus is on work—discussing work-related topics. What can be improved? Is everything running smoothly in the process?"

Another respondent stressed the emotional significance of interpersonal exchange:

> EA03: "It is extremely important. I always tell my colleagues that it doesn't matter what kind of work

you do. If you have good colleagues, everything runs smoothly, and the day is not bad at all."

At the same time, the interviews revealed that disrupted relationships can negatively impact information flow. One respondent noted:

AB04: "I would say it is important to very important. If people don't get along at all, there is a risk that information is not passed on or is only shared incompletely."

It is also noteworthy that many respondents maintain relationships with their colleagues outside the workplace, often developing friendships. Long tenures at the company particularly contribute to the formation of close and trusting relationships:

GA02: "Many have worked together for years. It's just common practice. And there are definitely some friendships."

These findings highlight the importance of social capital in the examined organisation—particularly from the perspective of individual employees who value affective and informal connections in their daily work. While these experiences are situated at the interpersonal level, they may inform how we understand the conditions under which social capital develops or erodes within digitally mediated work environments. The following section presents two themes identified through thematic analysis.

### *6.2 Theme 1: Autonomy Through Digital Self-Empowerment—Reduced Contact Frequency With Supervisors Primarily Affects Problem-Centred Communication*

The introduction of the worker assistance system had a noticeable impact on social interactions among employees. The system provides automated verification processes, digital access to work instructions, and optimised assembly processes. These digital functions reduce the need for direct communication and promote independent working. Previously, employees relied more on colleagues to obtain necessary documents such as circuit diagrams or parts lists. With the assistance system, they can now independently retrieve this information in digital form, reducing their reliance on direct contact and support from colleagues.

This is particularly evident in minor issues, such as wiring errors, where employees can now look up solutions in the digital documentation without needing assistance from a setter. Overall, the introduction of the worker assistance system has increased employees' independence and autonomy in the workplace, which has consequently reduced direct interpersonal interaction and exchange.

GA02: "Now, in many cases, you can help yourself because you can view the information in the drawing or circuit diagram. Especially with wiring errors, there's no longer a need for the setter to come down with the circuit plan. Instead, you can access the required information independently. The assembly instructions also often include visual cues on what the final result should look like. This makes you much more self-sufficient."

Some interviewees stated that digitalisation has simplified and made work processes more efficient, despite the decrease in direct colleague interaction.

EA05: "Of course, we still talk to each other, but contact has become less frequent compared to the past. However, back then, more interaction was necessary simply because digitalisation wasn't available. A lot had to be clarified in person, with extensive back-and-forth communication. Today, digitalisation allows us to consolidate information concisely, reducing the need for communication."

One of the most significant changes resulting from the use of the assistance system is the reduced frequency of interaction with supervisors. Previously, employees had to visit the setter regularly to collect circuit diagrams, drawings, or other documents in paper form. Today, these materials can be accessed digitally at the workstation, significantly reducing personal contact with the setter. Similarly, the introduction of the worker assistance system has led to a decline in interactions with the team leader. Information that was previously obtained directly from the team leader, such as assembly protocols or technical details, is now digitally available. As a result, digitalisation and the standardisation of information are increasingly replacing instrumental exchanges between employees and supervisors.

EA03: "It became clear that the setter was needed less because the system supports many functions. Previously, without access to drawings, you had to visit the setter to print documents or create a sample light fixture. Back then, such documents couldn't be accessed independently."

The reduction in instrumental exchanges has also led to a decline in informal communication, which was often conveyed incidentally during work interactions. One assembly worker with a supervisory role explained that informal communication now requires more proactive effort.

EA03: "In the past, conversations often occurred naturally—for example, when printing a drawing, you would talk to others and hear about updates or changes. Now, such spontaneous encounters happen less frequently, and obtaining information requires deliberate inquiry or direct engagement with colleagues. While conversations used to develop organically, communication now demands more initiative."

Additionally, direct colleague interactions have decreased, as colleagues were often the first point of contact for questions or assistance.

EA04: "Now, you just look at the drawing yourself, whereas before, you might have asked a colleague if a drawing was available or gone to the setter to have it printed."

EA04: "I think communication between people has changed because you now get information directly that you would have previously asked a colleague for. This makes work easier but also reduces personal interaction."

Some interviewees viewed the reduced contact frequency—particularly regarding formal issues—as a positive development. Employees appreciated the ability to resolve minor problems independently without involving a supervisor, as this was perceived as relieving and efficient. Instead of interrupting work processes to ask for assistance, employees could quickly resolve issues on their own. In such cases, the reduction in formal communication was seen as beneficial to interpersonal interactions and relationships within the organisation.

EA02: "Instead of bothering or calling the team leader with minor issues, I can simply mark the problem in the system so they can see it themselves. For bigger issues, we still find a solution together. But small and infrequent problems can be handled without unnecessarily disturbing anyone."

The changes in interaction and autonomy observed in Theme 1 were closely tied to shifts in the handling of knowledge at the workplace. Theme 2 explores how the introduction of the assistance system altered the balance between experiential knowledge and standardised, system-based information.

### *6.3 Theme 2: Data-Driven Knowledge Shift—Replacing Practical Product Knowledge With Digital Application Skills*

The interviews reveal that before the introduction of the assistance system, work was heavily based on personal experience, collegial exchange, and practical knowledge. Drawings and circuit diagrams were not always readily available, requiring employees to rely on their colleagues' expertise and support. Since standardised information was limited, assembly work was often performed intuitively or based on experience.

AB204: "In the past, we depended much more on learning from colleagues' experience and knowledge because drawings or material information were not available at the push of a button. It required more initiative and exchange to obtain the necessary information, which was primarily acquired through collegial input."

The assistance system now provides detailed technical drawings, exploded views, and parts lists in digital format, enabling employees to familiarise themselves with assembly processes more quickly and easily. Compared to earlier practices, where employees had to compile information manually, the assistance system significantly facilitates knowledge transfer. Additionally, employees can follow assembly steps on a monitor, which improves their understanding of the process. Only in highly specific cases, where the system does not provide an answer, does the exchange with experienced colleagues remain necessary.

The importance of experiential knowledge has declined due to automation and digitalisation, as information is now easily and quickly accessible. While knowledge-sharing among colleagues was once indispensable, the system now provides clear guidance. However, this also limits flexibility and makes fundamental changes more difficult due to strict, predefined processes. Although the structured approach is perceived as useful, it restricts adaptability, and experiential knowledge is increasingly retained within the system rather than being passed on informally.

AB205: "I think the system provides highly structured instructions that define every work step precisely. Experiential knowledge can now only be accumulated within the system itself, as fundamental changes or deviations—such as choosing alternative tools or more efficient methods—are not possible. Everything is predefined and fixed."

Moreover, the introduction of the assistance system has altered the role of practical experience and individual competencies. Since the system largely dictates the work processes, opportunities for employees to develop their own

solutions or alternative approaches have been significantly reduced. This shift has marginalised the importance of practical experience while increasing the relevance of digital skills, such as operating computers or software. Employees with strong digital competence are now perceived as more valuable because they can resolve issues within the system more efficiently. This transition indicates a clear shift towards prioritising digital knowledge over traditional experience.

> AB206: "Some employees have greater competence in areas such as using computers or laptops. These individuals are seen as more helpful because they can resolve technical problems more effectively or identify faster solutions."

Additionally, digital skills are more frequently attributed to younger colleagues.

> AB206: "The mindset of younger and older employees differs significantly. Younger workers focus more on digital aspects and working with computers, while older employees place greater value on craftsmanship and traditional work methods."

### *6.4 Summary of Findings and Comparison With Propositions*

The thematic analysis revealed four interrelated developments that characterise how digital assistance systems reshape work-related social dynamics in the examined departments:

1. **Increased autonomy of employees** through independent access to digitally standardised information.
2. **Decline in communication intensity**, particularly in hierarchical relationships (e.g., with team leaders and setters).
3. **Reduction of informal peer knowledge exchange**, especially in everyday troubleshooting and experience sharing.
4. **Shift in knowledge valuation, as experiential**, practice-based knowledge loses ground to digital competence and system literacy.

These findings are now compared with the theoretical propositions developed earlier.

Proposition 1—Reduction of Social Interactions is supported by several empirical observations. Interviewees reported a noticeable decline in communication with supervisors, as work instructions and technical information became digitally accessible. Instrumental exchanges that previously required interpersonal contact were increasingly absorbed into system routines. This shift also affected informal exchanges, which once occurred incidentally during work coordination. Some employees described this reduction as a welcome relief, allowing them to solve minor problems independently and efficiently. Rather than a simple reduction, the data suggest a reconfiguration of interaction patterns—away from face-to-face coordination and towards more autonomous forms of information handling.

Proposition 2—Decline in the Importance of Experiential Knowledge is also reflected in the findings. The availability of predefined digital workflows has reduced the relevance of tacit, experience-based knowledge in everyday work. Employees reported that formerly valued forms of craftsmanship and intuitive problem-solving have become less important, while digital skills have gained symbolic and practical weight. This change is often associated with generational differences, as younger workers are more familiar with digital systems. Additionally, the reduction in informal peer exchange (finding 3) limits the contexts in which experiential knowledge was traditionally shared—through personal contact, observational learning, or casual coordination.

While Proposition 2 focuses on the declining role of experiential knowledge, the findings suggest broader implications for social capital. As informal knowledge exchange and spontaneous sense-making diminish, the relational dimension (trust, mutual support) and the cognitive dimension (shared frameworks, informal learning cultures) may likewise be affected. These processes are closely intertwined with the way knowledge is socially embedded in work practices.

Taken together, the propositions are supported in differentiated ways. The findings indicate not only a reduction in social interaction and knowledge sharing, but also qualitative shifts in how relationships and expertise are enacted in digitally mediated environments.

Although the study focuses on interpersonal perceptions and micro-level practices, these dynamics offer insights into the broader conditions under which social capital is generated or constrained in organisations. The following section further elaborates these implications within the broader theoretical and practical context.

## 7. Discussion

The results of this study provide empirical evidence that digital assistance systems do not merely optimise workflows but also reshape the relational fabric of work. Rooted in the socio-technical tradition (Ropohl, 1999; Sydow, 1985; Trist and Bamforth, 1951), this perspective emphasises that technology actively configures the space for social interaction. In the case examined here, digital systems restructure how information is accessed, how coordination occurs, and how knowledge is shared—thereby influencing the very conditions under which social capital is formed and maintained. Several patterns emerged from the empirical material that can be interpreted through the lens of social capital theory.

First, respondents described a higher level of independence in their daily routines, enabled by system-based ac-

cess to information. While this autonomy was frequently experienced as a relief from hierarchical dependence, it also reduced opportunities for informal exchanges. From a social capital perspective, this may weaken the relational dimension (Nahapiet and Ghoshal, 1998), as trust and mutual support develop through regular, often incidental, interactions (Coleman, 1991). Second, the introduction of assistance systems led to a noticeable decline in the frequency and breadth of communication—particularly with supervisors. This reduction impacts the structural dimension of social capital, which is characterised by network density, connectivity, and information flow (Adler and Kwon, 2002; Leana and van Buren, 1999; Nahapiet and Ghoshal, 1998). With fewer points of contact, the opportunity to access timely knowledge or coordinate actions informally becomes more limited.

Third, informal peer-based knowledge sharing was described as less frequent and less central to task completion. This affects both the relational and cognitive dimensions of social capital: the weakening of personal ties and the loss of shared language and interpretive frameworks limit an organisation's capacity to contextualise information and act collectively (Nahapiet and Ghoshal, 1998). A fourth observation concerns the shifting valuation of knowledge. Digital competence increasingly overrides traditional, experience-based know-how. Older, more experienced workers lose their status as knowledge brokers, while digitally fluent employees gain recognition. This shift reflects not only a change in recognition structures but also a deeper reconfiguration of what constitutes valid knowledge in digitalised work environments. Especially experiential knowledge is often embodied, tacit, and situationally embedded (Böhle and Rose, 1992; Leonard and Sensiper, 1998; Nonaka and Takeuchi, 2012). Its erosion not only affects individual competence but also undermines the informal practices through which social learning and contextual understanding are sustained. As these practices are displaced by system-based information flows, the knowledge ecology within organisations becomes more rigid, less adaptive, and potentially less inclusive (Warnhoff and de Paiva Lareiro, 2019). The decline of these informal bridging roles may also generate new structural holes in the network (Burt, 1992, 2000). Although these insights are grounded in micro-level observations of social interaction and knowledge use, they open up theoretical perspectives on possible macro-level consequences (Jans, 2011; Matiaske, 1999). Coleman's (1991) macro–micro–macro model provides a useful analytical lens: macro structures (such as digital systems) shape the conditions for individual action, which in turn may aggregate into new structural patterns. Fig. 1 illustrates how digital systems may shape social capital following Coleman's macro–micro–macro logic.

Changes in interaction frequency, trust-building opportunities, and knowledge exchange routines can accumulate over time and may ultimately reshape the organisation's social capital architecture. While this study does not claim to empirically demonstrate such structural transformations, it highlights plausible aggregation mechanisms based on established theoretical models. This interpretation is supported by prior research on social capital. According to Nahapiet and Ghoshal (1998), effective knowledge integration depends on a balance of structural, relational, and cognitive resources. If this balance erodes, collective learning and coordination become increasingly difficult. Leana and van Buren (1999) define organisational social capital as a collective asset rooted in trust and shared purpose. Its resilience is jeopardised when informal social infrastructure is dismantled. Adler and Kwon (2002) further stress that the effects of social capital loss depend on contextual factors: organisations with highly formalised structures may adapt more easily, while those with traditionally informal knowledge cultures face more substantial disruption.

The empirical insights also highlight multiple tensions inherent in digital transformation. While employees gain autonomy, they lose opportunities for social integration. While information becomes more accessible, informal peer support declines. These ambivalences mirror Hirsch-Kreinsen's (2014, 2015) thesis of organisational polarisation, where digitalisation creates new spaces for self-organisation while simultaneously marginalising established actors and practices. Pfeiffer (2019) identifies a similar paradox: digital autonomy may decouple individuals from the relational dynamics that previously shaped their work. Taken together, these developments suggest that digital assistance systems are not merely technical instruments, but socio-technical infrastructures that reconfigure the patterns through which social capital is formed, maintained, or eroded. Understanding their impact therefore requires not only technical but also social and organisational foresight.

The results of this study highlight that digital assistance systems must be understood not only as tools for process optimisation but as interventions in the social fabric of organisations. From a socio-technical perspective, technologies are not neutral but shape patterns of coordination, communication, and knowledge exchange. Consequently, their implementation should be accompanied by a conscious alignment with existing social structures. Participatory design approaches can support this alignment and help maintain trust and legitimacy within the workforce (Winby and Mohrman, 2018).

One central risk lies in the erosion of informal exchange and the sidelining of experience-based knowledge. As shown in this study, system-based information provision reduces spontaneous interaction and diminishes the role of contextual problem-solving among peers. However, practical workplace knowledge is often situated, embodied, and conveyed through informal interaction. Nonaka and Takeuchi (2012) argue that this type of knowledge cannot be fully captured in formal systems but depends on shared

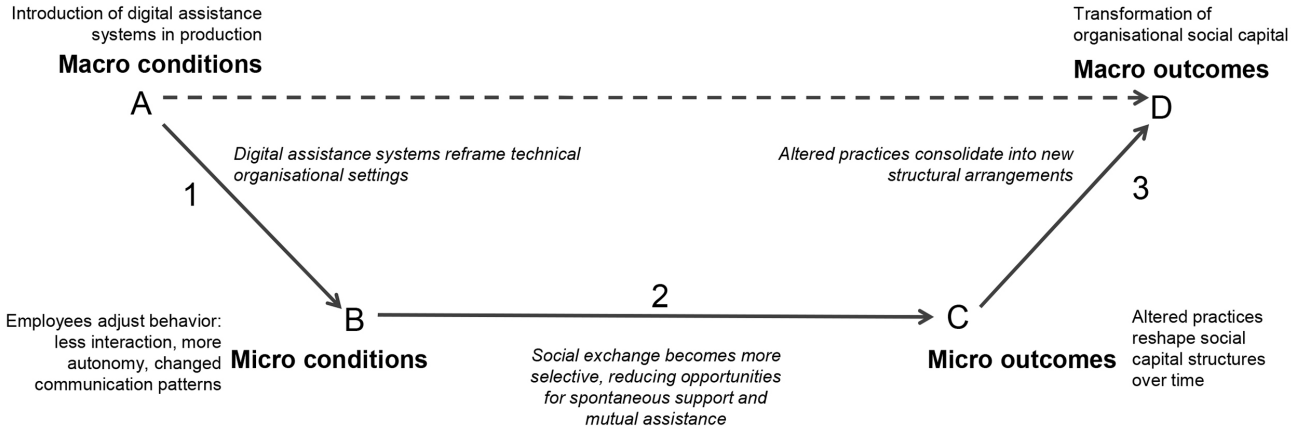


**Fig. 1. Digital structuring and social capital: a macro–micro–macro perspective**.

experience and mutual understanding. Böhle (2015) similarly emphasises that learning from experience requires socially embedded reflection, not just access to formalised information. To preserve these learning processes, organisations must actively maintain informal spaces—physical or digital—in which dialogue, mutual support, and situational insight can continue to develop.

Beyond knowledge dynamics, the study also points to shifting patterns of recognition and organisational cohesion. Digital skills are becoming more visible and valued, while long-standing forms of practical expertise are losing prominence. This shift risks symbolic exclusion and may contribute to organisational fragmentation (Böhle, 2015; Pfeiffer, 2019). At the same time, digitalisation can foster individual autonomy while weakening social ties, reinforcing the pattern of polarised organisational development described by Hirsch-Kreinsen (2014). Organisations must therefore ensure that their digital transformation strategies not only optimise processes but also safeguard the relational foundations of collective work.

As with any qualitative case study, this research is limited in its scope and generalisability. Focusing on a single organisation and two departments within the production sector, the findings reflect context-specific insights that cannot be transferred to other settings without caution. The study offers a micro-level, interpretive account rather than statistical generalisation. Social capital was explored through subjective accounts of interpersonal dynamics, such as perceived support, communication practices, and relational proximity. The study does not rely on formal network metrics or standardised constructs. Future research could combine qualitative perspectives with structural analyses to broaden the explanatory scope. Moreover, the empirical material reflects short-term changes following the introduction of the assistance system. Since relational structures and shared meaning evolve over time, longitudinal designs are needed to capture delayed or cumulative effects on social cohesion and knowledge sharing.

Finally, the results are based on a specific type of rule-based assistance system. Other technologies, such as artificial intelligence (AI)-driven systems, collaborative robotics, or augmented reality, may lead to different patterns of interaction. Future studies should therefore compare various forms of digitalisation and examine how technology-induced changes in social interaction may translate into broader organisational consequences.

## 8. Conclusion

This study shows that digital assistance systems significantly influence the social dynamics of work. By reducing interpersonal contact and shifting communication towards system-based information provision, they affect the conditions under which social capital develops and is sustained. Informal interactions—long considered a central medium for support, coordination, and knowledge sharing—are increasingly constrained. While this may enhance autonomy and efficiency, it also carries the risk of weakening relational and cognitive resources that underpin collective performance. Moreover, the findings suggest that digitalisation not only dissolves established patterns of experiential knowledge exchange but may also lead to new forms of asymmetry. As digital competence gains in importance, traditional roles based on practical experience lose visibility. This reconfiguration of status and expertise highlights the need for organisations to actively manage the social implications of technological change.

Future research should further explore how digital systems restructure interaction patterns over time and how these changes influence both individual-level experiences and the broader cohesion of organisational networks. In particular, longitudinal and comparative studies could help uncover whether new forms of informal coordination and social capital emerge under digital conditions—or whether digitalisation primarily accelerates structural fragmentation.

## Availability of Data and Materials

Anonymized interview transcripts supporting the findings of this study are available from the corresponding author upon reasonable request.

## Author Contributions

JMK developed the original research idea and the overall study framework, conducted the empirical investigation, analyzed the data, and prepared the initial version of the manuscript. CK contributed substantially to the methodological design and refinement of the research approach. Both authors critically reviewed and revised the manuscript, approved the final version, and accept responsibility for the accuracy and integrity of the published work.


## Acknowledgment

The authors gratefully acknowledge the participating company for providing access to the research field and all interview participants for sharing their time and insights.

## Funding

This research received no external funding.


## Conflicts of Interest

The authors declare no conflicts of interest.

## Declaration of AI and AI-Assisted Technologies in the Writing Process

During the preparation of this work, the authors used ChatGPT-4o and DeepL to support translation and language editing, including checking spelling, grammar, and phrasing. After using these tools, the authors reviewed and edited the content as needed and took full responsibility for the content of the publication.

## References


Adler PS, Kwon SW. Social capital: Prospects for a new concept. Academy of Management Review. 2002; 27: 17–40. https://doi.org/10.5465/amr.2002.5922314

Apt W, Bovenschulte M, Priesack K, Weiß C, Hartmann EA. „Einsatz von digitalen Assistenzsystemen im Betrieb": Im Auftrag des Bundesministeriums für Arbeit und Soziales. Institut für Innovation und Technik. 2018. (In German)

Bauernhansl T, ten Hompel M, Vogel-Heuser B. Industrie 4.0 in Produktion, Automatisierung und Logistik. Springer: Wiesbaden. 2014. (In German)

Böhle F. Erfahrungswissen jenseits von Erfahrungsschatz und Routine. In Dietzen A, Powell JJW, Bahl A, Lassnigg L (eds.) Soziale Inwertsetzung von Wissen, Erfahrung und Kompetenz in der Berufsbildung (pp. 34-63). Beltz Juventa: Weinheim. 2015. (In German)

Böhle F, Rose H. Technik und Erfahrung: Arbeit in hochautomatisierten Systemen. Campus Verlag: Frankfurt am Main. 1992. (In German)

Bourdieu P. Ökonomisches Kapital, kulturelles Kapital, soziales Kapital. In Kreckel R (ed.) Soziale Ungleichheiten. Soziale Welt. Sonderband 2 (pp. 183-198). Verlag Otto Schwartz & Co.: Göttingen. 1983. (In German)

Braun V, Clarke V. Successful qualitative research: A practical guide for beginners. Sage Publications Ltd: London. 2013.

Braun V, Clarke V. Using thematic analysis in psychology. Qualitative Research in Psychology. 2006; 3: 77–101. https://doi.org/10.1191/1478088706qp063oa

Burt RS. Structural Holes. Harvard University Press: Harvard. 1992. https://doi.org/10.4159/9780674029095

Burt RS. The network structure of social capital. Research in Organizational Behavior. 2000; 22: 345–423. https://doi.org/10.1016/S0191-3085(00)22009-1

Clarke V, Braun V. Thematic analysis. The Journal of Positive Psychology. 2017; 12: 297–298. https://doi.org/10.1080/17439760.2016.1262613

Coleman JS. Grundlagen der Sozialtheorie. Scientia nova. Oldenbourg: Berlin, Boston. 1991. (In German)

Coleman JS. Social capital in the creation of human capital. American Journal of Sociology. 1988; 94: S95–S120. https://doi.org/10.1086/228943

Dudwick N, Kuehnast K, Jones VN, Woolcock M. Analyzing social capital in context. A Guide to Using Qualitative Methods and Data (pp. 1–46). World Bank Institute: Washington, D.C. 2006.

Elliott J. Using narrative in social research: Qualitative and quantitative approaches. Sage Publications Ltd: London. 2005.

Esser H, Kroneberg C. An integrative theory of action: The model of frame selection. In Order on the Edge of Chaos: Social Psychology and the Problem of Social Order (pp. 63-85). Cambridge University Press: New York. 2015. https://doi.org/10.1017/CBO9781139924627.005.

Esser H. Soziologie: Spezielle Grundlagen: Band 1: Situationslogik und Handeln (Studienausgabe). Campus Verlag: Frankfurt am Main, New York. 1999. (In German)

Flick U. Qualitative Sozialforschung: Eine Einführung. 11th edn. Rowohlts Enzyklopädie im Rowohlt Taschenbuch Verlag: Reinbek bei Hamburg. 2025. (In German)

Grootaert C, Narayan D, Jones VN, Woolcock M. Measuring social capital: An integrated questionnaire. The World Bank: Washington, D.C. 2004.

Guest G, MacQueen KM, Namey EE. Applied thematic analysis. SAGE Publications: Thousand Oaks, CA. 2011.

Hirsch-Kreinsen H. Industrie 4.0: Entwicklungsperspektiven von Arbeit: Technologieschub mit eindeutigen Konsequenzen? Ifo Schnelldienst. 2015; 68: 13–15. (In German)

Hirsch-Kreinsen H, ten Hompel M. Digitalisierung industrieller Arbeit: Entwicklungsperspektiven und Gestaltungsansätze. In Vogel-Heuser B, Bauernhansl T, ten Hompel M (eds.) Handbuch Industrie 4.0 Bd. 3 (pp. 357–376). Springer

Vieweg: Berlin, Heidelberg. 2017. https://doi.org/10.1007/978-3-662-53251-5_21 (In German)

Hirsch-Kreinsen H. Wandel von Produktionsarbeit-„Industrie 4.0 "(Soziologisches Arbeitspapier, 38). Wirtschafts-Und Sozialwissenschaftliche Fakultät, Technische Universität Dortmund: Dortmund. 2014. (In German)

Hollstein B, Pfeffer J. Netzwerkkarten als Instrument zur Erhebung egozentrierter Netzwerke. In Soeffner HG (ed.) Unsichere Zeiten: Herausforderungen gesellschaftlicher Transformationen. Verhandlungen des 34. Kongresses der Deutschen Gesellschaft für Soziologie in Jena 2008 (pp. 1-13). Campus: Frankfurt am Main. 2010. (In German)

Hollstein B. Qualitative Methoden und Netzwerkanalyse—ein Widerspruch? In Hollstein B, Straus F (eds.) Qualitative Netzwerkanalyse (pp. 11–35). Springer: Wiesbaden. 2006. https://doi.org/10.1007/978-3-531-90074-2_1 (In German)

Jans M. Sozialkapital und Personalwirtschaft: Ein Modell zur Erklärung der Wirkungen des Beziehungs- und Organisationskapitals auf personalwirtschaftliche Funktionszusammenhänge. Hampp: München, Mering. 2011. (In German)

Jansen D. Einführung in die Netzwerkanalyse: Grundlagen, Methoden, Forschungsbeispiele. 3rd rev. edn. VS Verlag für Sozialwissenschaften: Wiesbaden. 2006. (In German)

Kagermann H, Wahlster W, Helbing J. Deutschlands Zukunft als Produktionsstandort sichern - Umsetzungsempfehlungen für das Zukunftsprojekt Industrie 4.0: Abschlussbericht des Arbeitskreises Industrie 4.0. Berlin; April. 2013. (In German)

Kiger ME, Varpio L. Thematic analysis of qualitative data: AMEE Guide No. 131. Medical Teacher. 2020; 42: 846–854. https://doi.org/10.1080/0142159X.2020.1755030

Krackhardt D, Hanson JR. Informal networks: The company behind the chart. Harvard Business Review. 1993; 71: 104-111.

Leana CR, van Buren HJ. Organizational Social Capital and Employment Practices. The Academy of Management Review. 1999; 24: 538–555. https://doi.org/10.5465/amr.1999.2202136

Leonard D, Sensiper S. The Role of Tacit Knowledge in Group Innovation. California Management Review. 1998; 40: 112–132. https://doi.org/10.2307/41165946

Lin N. Social capital: A theory of social structure and action. Cambridge University Press: Cambridge. 2001.

Lochmiller CR. Conducting Thematic Analysis with Qualitative Data. The Qualitative Report. 2021; 26: 2029–2044. https://doi.org/10.46743/2160-3715/2021.5008

Matiaske W. Soziales Kapital in Organisationen: Eine tauschtheoretische Studie. Hampp: München, Mering. 1999. (In German)

Meissner JO. Beziehungsherausforderungen in kommunikativ hybriden Arbeitsumgebungen. Zeitschrift Für Management. 2009; 4: 307–326. https://doi.org/10.1007/s12354-009-0107-z (In German)

Nahapiet J, Ghoshal S. Social Capital, Intellectual Capital, and the Organizational Advantage. The Academy of Management Review. 1998; 23: 242–266. https://doi.org/10.2307/259373

Niehaus J. Mobile Assistenzsysteme für Industrie 4.0: Gestaltungsoptionen zwischen Autonomie und Kontrolle (Digitalisierung von Arbeit - Industrie 4.0). FGW – Forschungsinstitut für gesellschaftliche Weiterentwicklung e.V. 2017. (In German)

Nonaka I, Takeuchi H. Die Organisation des Wissens: Wie japanische Unternehmen eine brachliegende Ressource nutzbar machen. 2nd edn. Campus Verlag: Frankfurt, New York. 2012. Available at: http://www.content-select.com/index.php?id=bib_view&ean=9783593416625 (Accessed: 16 January 2025). (In German)

Opp KD. Rational Choice Theory and Methodological Individualism. In Kivisto P (ed.) The Cambridge Handbook of Social Theory (pp. 1–23). Cambridge University Press: Cambridge. 2020. https://doi.org/10.1017/9781316677452.002

Orlikowski WJ. Sociomaterial Practices: Exploring Technology at Work. Organization Studies. 2007; 28: 1435–1448. https://doi.org/10.1177/0170840607081138

Pfeiffer S. Digitale Arbeitswelten und Arbeitsbeziehungen: What you see is what you get? Industrielle Beziehungen. Zeitschrift Für Arbeit, Organisation Und Management. 2019; 26: 232–249. https://doi.org/10.3224/indbez.v26i2.07

Portes A. Social Capital: Its Origins and Applications in Modern Sociology. Annual Review of Sociology. 1998; 24: 1–24. https://doi.org/10.1146/annurev.soc.24.1.1

Putnam RD. Bowling alone: The collapse and revival of American community. 1st Touchstone edn. Simon & Schuster: London. 2001a.

Putnam RD. Social capital: Measurement and consequences. Canadian Journal of Policy Research. 2001b; 2: 41–51.

Reinbacher P. Sozialkapital als affektive Struktur sozialer Systeme. Swiss Journal of Sociology. 2017; 43: 15–36. https://doi.org/10.1515/sjs-2017-0002 (In German)

Rice RE, Leonardi PM. Information and communication technologies in organizations. In The SAGE handbook of organizational communication: Advances in theory, research, and methods (pp. 425–448). Sage: Thousand Oaks, CA. 2014.

Ropohl G. Allgemeine technologie: eine systemtheorie der technik. KIT Scientific Publishing: Karlsruhe. 2009. (In German)

Ropohl G. Philosophy of Socio-Technical Systems. Society for Philosophy and Technology Quarterly Electronic Journal. 1999; 4: 186–194. https://doi.org/10.5840/techne19994311

Sydow J. Der soziotechnische Ansatz der Arbeits- und Organisationsgestaltung: Darstellung, Kritik, Weiterentwicklung. Campus Verlag: Frankfurt am Main, New York. 1985. (In German)

Syska A, Lièvre P. Illusion 4.0: Deutschlands naiver Traum von der smarten Fabrik. CETPM GmbH Institut an der Hochschule Ansbach: Herrieden. 2016. (In German)

Trist EL, Bamforth KW. Some Social and Psychological Consequences of the Longwall Method of Coal-Getting: An Examination of the Psychological Situation and Defences of a Work Group in Relation to the Social Structure and Technological Content of the Work System. Human Relations. 1951;

4: 3–38. https://doi.org/10.1177/001872675100400101

Ulich E. Arbeitspsychologie. 7th edn. vdf Hochschulverlag: Zürich. 2020. (In German)

Ulich E. Arbeitssysteme als soziotechnische Systeme-eine Erinnerung. Journal Psychologie Des Alltagshandelns. 2013; 6: 4–12. (In German)

Warnhoff K, de Paiva Lareiro P. Skill development on the shop floor-heading to a digital divide? In Proceedings of the Weizenbaum Conference 2019 "Challenges of Digital Inequality - Digital Education, Digital Work, Digital Life". Berlin. Weizenbaum Institute for the Networked Society - The German Internet. 2019.

Wenger-Trayner É. Communities of practice: learning, meaning, and identity (13. print). Learning in doing: social, cognitive, and computational perspectives. Cambridge Univ. Press: Cambridge. 2005.

Winby S, Mohrman SA. Digital Sociotechnical System Design. The Journal of Applied Behavioral Science. 2018; 54: 399–423. https://doi.org/10.1177/0021886318781581

Yin RK. Case study research: Design and methods. 5th edn. Sage: Los Angeles, CA. 2014.