

Degree Project

Master's Degree

Knowledge Management and ICT Adaptions as a Result of Pandemic Workplace Restrictions

A Case Study at a SME in Germany

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Abstract

Aim. The purpose of this degree project was to assess the impact of the sudden, historically-unique COVID-19 workplace restrictions on the knowledge management and interrelated ICT utilization of a knowledge-intensive SME in Germany. Based upon the outcomes of this assessment, suggestions for future advancement were to be developed.

Research Approach. The research approach entailed a qualitative case study addressing a single IT company with 42 employees. The research itself was conducted via triangulation, with the semi-structured interviews of four purposely sampled company executives serving as the focal part. Fundamental aspects of these interviews were further substantiated through four exploratory meeting observations and a company-wide questionnaire contributing 14 employee responses.

Findings. Subject to the pandemic-related workspace restrictions, this company was forced to transition to predominantly virtual operations. The organization responded through the introduction of a new, integrated ICT for employee collaboration while simultaneously expediting the codification of tacit knowledge across two existing knowledge repositories. This focus on only a few essential ICTs led to a reduction of prior systems clutter and the company-wide accessibility of explicit knowledge – a quantum leap in terms of efficiency. Along with the primary collaboration via ICTs, a new interaction etiquette developed amongst employees, and IT-related staff was found to cooperate more actively than in the previous on-site environment. Given these insights, this German IT house is recommended to continue its emergently hybrid knowledge management strategy and consider the benefits of both the physical and virtual spaces for an office redesign past the COVID-19 limitations.

Originality. Academic references attending to knowledge management during forced workplace restrictions were de facto nonexistent. Adding to it, previous studies on virtual knowledge management indicated a deterioration of performance as compared to on-site operations. This case study is hence not only unique by its pandemic link, but also countering apparent academic presupposition.

Keywords. Knowledge management, knowledge-intensive firm, information and communication technologies, Covid-19 pandemic, Ba, workspaces, virtual knowledge management, small- and medium-sized enterprises.

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Table of Abbreviations

API.....	Application Programming Interface
CEO.....	Chief Executive Officer
Dept.....	Department
GDPR.....	General Data Protection Regulation
HR.....	Human Resources
ICT.....	Information and Communication Technology
IP.....	Intellectual Property
IT.....	Information Technology
KM.....	Knowledge Management
MGR.....	Manager
MS.....	Microsoft
NDA.....	Non-Disclosure Agreement
SME.....	Small- and Medium-Sized Enterprises
VPN.....	Virtual Private Network

1 Introduction

The following three sub-sections intend to provide a comprehensive introduction to this case study on knowledge management (KM) and Information and Communication Technologies (ICT) utilization during pandemic workplace restrictions. It starts with a brief problematization leading to the research aim and question; and ends with an outline of the resulting thesis structure.

1.1 Research Background

While only a few decades ago the accessibility and disposability of people and manual labor, natural resources, and financial capabilities constituted the core values of a corporation, it is meanwhile knowledge that represents one of the most important assets a company possesses (Alvesson, 1995, Hislop et al., 2018).

By spurring new ideas and enabling competent decision-making, knowledge propels the innovativeness and efficiency of an organization (Alvesson, 1995; Chong & Chong, 2009). As the latter two are considered essential components to an organization's competitiveness, knowledge hence signifies a critical business delineator (Hebibi, Raimi & Milićević, 2019). It is against this very notion that the concept of the knowledge-intensive firm has seen a steep rise in global attention (Alvesson, 1995). At its core, this term refers to high-tech companies whose employees possess a substantial degree of competence and experience, typically applied as part of research and development activities (Alvesson, 1995). In these companies, however, it is not just the availability of knowledge that is vital, but likewise the means of sharing and managing it appropriately (Hansen et al., 1999, Styhre, 2002).

In support of the above, companies can use a wide array of information and communication technologies (ICT) across a multitude of business areas. ICTs encompass e.g. collaboration and planning tools, employee directories, and a bandwidth of knowledge repositories, amongst others (Earl, 2001; Hislop et al., 2018).

Despite these possibilities, the degree as well as the forms of ICT adoption diverge substantially between enterprises. Multi-National Corporations (MNC), for example, require a variety of ICTs to manage their knowledge and activities across a globally dispersed business environment (Giotopolous et al., 2017; Al-Qdah et al., 2018; Davenport & Prusak, 1998). In other words, MNCs naturally maintain an ICT infrastructure to support remote

knowledge management. Small- and medium-sized enterprises (SME), in contrast, operate predominantly in domestic settings and feature fewer overall staff. Under these conditions, person-to-person exchange is generally possible on a regular basis, leaving employees with a “reliable grasp of collective organizational knowledge” (Davenport & Prusak, 1998, p. 14), and little need for integrated knowledge management ICTs.

Differences in national capabilities and habits may, similarly to variations by organizational size and operations, affect the use of ICTs for knowledge management. In Scandinavian countries, for instance, working from home was found substantially more common than e.g. in southern European countries or Germany (Reuschke & Felstead, 2020). Globally admired for its innovative and high performing ‘German Mittelstand’ (or: SMEs), the latter nation is said to maintain a particularly pronounced office presence culture (Heller, 2013; Bundesministerium für Wirtschaft und Energie, 2021).

The outbreak of the Covid-19 pandemic in spring 2020 marks a violent caesura in this regard. Since then, many countries including Germany have imposed wide-ranging restrictions on personal interaction and office utilization (Federal Ministry for Economic Affairs and Energy, 2017; Die Bundesregierung, 2021). Independent of size or preparedness, this pandemic event has hence forced companies to operate virtually literally overnight (Kniffin et al., 2021) – a contemporary, unique, and largely unexplored precedent in terms of the exchange and management of knowledge.

1.2 Research Aim and Question

Arising from the above introduction, this Master thesis aims at exploring the knowledge management and according utilization of information and communication technologies at a knowledge-intensive SME in Germany in general, and the changes implied as a result of Covid-19 workplace restrictions in particular. Based upon these findings and a thorough literature review, recommendations for future advancements in knowledge and ICT management were to be developed. The according research question is divided into the two main parts as follows:

“How have COVID-19 workplace restrictions affected knowledge management and ICT utilization at a knowledge-intensive SME in Germany, and what according suggestions for future advancement can be developed.”

By answering the above research question, this thesis caters to the field of organizational theory, which considers knowledge management as an integral component of business reflected through strategies, guidelines, actions, and perceptions at every level of an organization (Dalkir, 2005; Barclay & Murray, 1997). More precisely, this thesis intends to contribute to existing literature by addressing the supposition that SMEs in Germany would struggle to cope with the COVID-19-induced virtualization, and that established knowledge management efficiencies would tend to diminish in home office settings as compared to on-site operations.

1.3 Structure of the Document

Following this introduction, section 2 intends to provide a comprehensive insight into existing academic literature, with Hansen et al.'s (1999) knowledge management strategy framework as well as Nonaka et al.'s (Nonaka & Konno, 1998; Nonaka & Takeuchi, 1995; Nonaka et al., 2000, 2006) spaces for knowledge management serving as overarching themes.

Section 3 attends to the research design of this single, qualitative case study. It entails, first and foremost, the partitioning of the research question into its fundamental components, and the linkage of the latter to the aforementioned theories. In an effort to substantiate the approach, a triangulation between qualitative interviews, observations, and a questionnaire, was deemed most appropriate. The result is a division of questions, which provides the structure and elements for the execution of this exploration, the according assessment (Section 4) and a detailed discussion (Section 5). The discussion part itself addresses not only the findings from the triangulation but furthers them through recommendations for future knowledge management advancement.

Section 6, finally, intends to wrap the entire document into a brief yet comprehensive conclusion.

2 Theoretical Framework

As indicated above, the aim of this section is to serve as a theoretical framework. It will hence begin with an outline of basic definitions and typologies on knowledge and knowledge management. Based upon this essential foundation, the next sub-section will provide insights into common typologies for knowledge and the knowledge-intensive firm as well as corporate knowledge management strategies, followed by a brief review of the most renowned theory on physical, virtual, and mental knowledge management spaces and expedient literature on the fostering of virtual knowledge management.

2.1 Basic Knowledge Typologies and the Knowledge-Intensive Firm

According to Nonaka and Takeuchi (1995), knowledge can be defined as “justified true belief” (p. 58). This perspective, which may appear abstract at first glance, gains plausibility when considering the hierarchical framework of Aamodt and Nygård in the context of decision making. Aamodt and Nygård (1995) regard data as the foundation, with information and knowledge building upon it. Information, according to the authors, would arise from the interpretation of data, while knowledge would come into play whenever information is applied as a ‘reasoning resource’ for decision making. Along those same lines, Davenport and Prusak (1998) acknowledge that knowledge would be considerably richer and hence would reach significantly deeper than both data and information.

Based upon this fundamental definition, knowledge can be further delineated into two core types, that is, tacit and explicit knowledge. Tacit knowledge, on one end, is defined as personal, subjective, and context specific. As such, tacit knowledge is considered difficult to share or express in a codifiable form (Nonaka et al., 2000, as cited in Hislop et al., 2018). Examples of tacit knowledge include the riding of a bicycle, particular craftsmanship, understanding of company culture, and other such examples where knowledge has been developed over time, but cannot easily be transferred or even codified. Explicit knowledge, on the other end, is deemed impersonal, objective, and independent of context. Explicit knowledge would hence be easy to share and codify (Nonaka et al., 2000), with examples encompassing corporate instructions, manuals, reports, and the like. Nonaka and Takeuchi (1995) attest that both forms of knowledge to coexist in most every company.

Transferring these perspectives to the use of knowledge in companies, Sveiby (2001) notes that knowledge, independent of its form, represents the ability of people to evaluate information, act efficiently and generate value.

It is therefore only consequent that the importance of knowledge as the core means of corporate competitiveness has emerged substantially over factors like labor and capital in recent years. In line with this development, the concept of the knowledge-intensive firm has thus become utmost popular. One of the most prominent definitions of the knowledge-intensive firm is contributed by the Swedish scholar Mats Alvesson (2001, p. 863), describing them as:

“Companies where most work can be said to be of an intellectual nature and where well-educated, qualified employees form the major part of the workforce”

In these companies, knowledge is applied collectively and predominantly to address novel challenges, conduct research activities and/or develop new product or service solutions (Lee, 1999; Swart & Kinnie, 2003). It may hence appear as a natural linkage that consulting and Information Technology (IT) companies are commonly considered knowledge-intensive firms (Alvesson, 2001). As another interlinked observation, knowledge-intensive firms are particularly dependent on the minds and networking capabilities of their employees as well as on corresponding support systems (Alvesson, 2001), executive leadership and a sound knowledge management strategy (Alavi & Leidner, 2001).

2.2 Knowledge Management Frameworks and Strategies

Numerous frameworks and strategies for managing knowledge have emerged over time. Alvesson and Kärreman (2001), for example, craft an analytical matrix spanning across the mode of managerial intervention on one axis, and the mode of interaction on the other, with multiple strategic approaches being possible in parallel (Hislop et al., 2018). Similar yet different, Earl (2001) refers to a total of seven ideal categories, or ‘schools’, to host and manage knowledge. To define the appropriate blend, companies would need to assess their requirements through an iterative process, with little further guidance granted by the author. In contrast to these prementioned models, Hansen et al. (1999) offer a schematically simplistic framework for knowledge management which distinguishes solely between two knowledge management dimensions – codification and personalization. It may be this simplicity in combination with clear management advices that has turned Hansen et al.’s

personalization versus codification framework into one of the “most influential typologies” (Hislop et al., 2018, p. 60) of its kind.

2.2.1 Hansen et al.’s (1999) Codification vs. Personalization Framework

The codification strategy builds upon the supposition that most knowledge within an organization can actually be made explicit. Knowledge, in this scenario, could thus be separated from individual employees and converted into context-independent, objective, intelligible, storable and searchable formats. The commercial value of this strategy emerges from the reuse of the codified knowledge, enabling scale effects and concomitantly benefitting standardized product and service portfolios. In contrast, the personalization strategy grounds upon tacit knowledge as the prime form of knowledge within a company. The latter would empower corporate competitiveness through collaborative knowledge creation and be tightly linked to innovative, customized product and service offerings (Hansen et al., 1999; Hislop et al., 2018). To identify the most appropriate knowledge management strategy for an organization, Hansen et al. (1999) have conceptualized the following three simple, delineating questions:

- Does the corporation offer standardized or customized products?
- Does the corporation feature mature or innovative products?
- Do the employees of the corporation rely on explicit or tacit knowledge to solve problems?

Once a suitable knowledge management strategy has been identified by means of these questions, Hansen et al. (1999) provide espousing suggestions in the fields of Human Resources (HR) and Information and Communication Technology (ICT).

In terms of the codification strategy, and with re-use of knowledge in mind, the authors propose substantial investments into electronic documentation systems and repositories. As these ICT unfold their value only upon the availability of explicated knowledge, companies would thus be held to establish trainings as well as sound incentives to aid the transfer of knowledge from employees to documents. Once core knowledge is universally accessible and comprehensive, companies would tend to hire young, inexperienced and inexpensive staff. The personalization strategy, on the other hand, aims at personal (tacit) knowledge exchange amongst employees. Companies leaning towards this approach would typically co-locate employees to ensure optimal collaboration and networking (Hansen et al., 1999, p.

111), with ICT systems only serving as means of support. Such companies should consider rewards for team collaboration and expand upon according interpersonal staff capabilities and skills. In terms of hiring policy, the personalization strategy works best with staff open to problem solving and joining equipped with prior experience (Hansen et al., 1999).

Table 1

Codification and Personalization Knowledge Strategies

Knowledge Strategy	Codification	Personalization
Business-Knowledge Link	Competitive advantage through knowledge reuse	Competitive advantage through knowledge creation
Relevant Knowledge Process and ICT	Transferring knowledge from people to documents and ICT systems	Facilitation of collaboration and tacit knowledge exchange between people e.g. via ICT systems
HRM Implications	Motivate people to codify their knowledge Training should emphasize the development of ICT skills Reward people for codifying their knowledge Hire and cultivate young staff	Motivate people to share their knowledge with others Training should emphasize the development of interpersonal skills Reward people for sharing knowledge with others Hire experts with inventor mindsets

Note: Modified from Hansen et al., 1999, and Hislop et al., 2018, p. 61

Hansen et al. (1999) posit that any knowledge management strategy should not only be in line with the overall business strategy but concentrate on either codification or personalization to maximize success. Nevertheless, the authors acknowledge that the exclusive focus on just one of the two aforementioned strategies may prove to be problematic. On the one hand, different business units or departments within the same company may find different knowledge management approaches suitable (Hansen et al., 1999; Scheepers et al., 2004). On the other hand, even in companies in which the codification strategy predominates, an occasional person-to-person exchange amongst employees may be required e.g. to analyze or improve processes, structures, or documentation. Likewise, a company that focuses on a personalization strategy would still have to maintain a certain degree of documentation. Along those lines, Hansen et al. (1999) advocate for an 80/20 split in favor of one knowledge management strategy to avoid dissipation.

2.2.2 Evolutionary Pathways of Hansen et al.'s (1999) Framework

Scheepers et al. (2004) find empirical evidence supporting Hansen et al.'s (1999) 80/20 ratio between personalization and codification for early knowledge management initiatives. In fact, they attest that a vague, unfocused initial approach would imply significant risks. However, once a particular knowledge management direction has been successfully established, companies would need to gradually evolve to an equal distribution between the two codification and personalization to make most effective use of the entire organizational knowledge. In other words, companies may embrace a personalization pathway from start, but would over time evolve by adding codification to their strategy; and vice versa.

2.3 Knowledge Management Spaces and Covid-19

Apart of strategy, an enabling facet to successful knowledge management is space. On one side, this is due to the fact that knowledge is typically shared and managed at the workplace – the physical place or space where employees execute their jobs (Cambridge Dictionary, n.d.; De Lucas Ancillo et al., 2020). On the other side, scholars like Earl (2001) and Hislop et al. (2018) expound on the vibrant diversity of ICTs (or: virtual spaces) to support knowledge management.

2.3.1 Nonaka's Knowledge Management Spaces (Ba)

Particular to spaces for knowledge management, one of the most frequently cited authors is the Japanese scholar Ikujiro Nonaka. Together with Takeuchi, Nonaka (1995) ideated and published the so called SECI model. SECI is an abbreviation for an iterative knowledge creation and conversion process organized in the four sequential phases Socialization (S), Externalization (E), Combination (C), and Internationalization (I). It describes the “change in level of knowledge” (Hislop et al., 2018, p. 114) beginning with the tacit interaction between individuals (socialization), where emotions, experiences, and mental models are shared. For socialization, Nonaka and Konno (1998) posit the need for physical proximity to acquire knowledge through interaction. The second process phase, externalization, describes the conversion from tacit to explicit knowledge, where individuals formulate their tacit knowledge in consciously constructed formats comprehensible to third parties (Nonaka & Konno, 1998). In practice, externalization hence involves techniques and/ or technology supporting self-expression such as language and visualizations, amongst others (Nonaka & Konno, 1998). The third phase encompasses the amplification through a combination of

explicit knowledge, or explicit to explicit, between the group and the organization, in an ambition to systemize it. Internalization, the fourth phase, finally describes the conversion process from explicit to tacit format as part of individuals retrieving knowledge from the organization (Nonaka & Konno, 1998).

The basic condition for this process to work, according to Nonaka et al. (2000), is the existence of suitable space. Space, or 'Ba' in Japanese language, is defined as a shared, enabling context for exchange and the creation of relationships (Nonaka & Konno, 1998; Nonaka et al., 2000). This context is considered so immanent, that the authors in fact contend knowledge creation and sharing to be nonexistent without it. They attest that "Ba is the place where information is interpreted to become knowledge" (Nonaka et al., 2000, p. 14).

But Ba as enabling context not only resides in physical spaces like office workplaces, coffee areas, and meeting rooms. It also involves aspects of virtual spaces (e.g. e-mails, telephone conferences, and intranets) as well as mental spaces encompassing ideas, emotions, and shared experiences as well as common goals and understanding (Nonaka & Konno, 1998; Nonaka et al., 2000; Nonaka et al., 2006). Mental spaces would hence also represent the culture and habits of how knowledge is management in a certain company, which spaces are utilized for this purpose, and how and in which forms interaction would typically be executed.

Nonaka et al. (2000) point at top management to furnish and facilitate Ba for optimal knowledge sharing and creation. That is, to capture and expand Ba wherever and whenever it is naturally emerging, and intentionally create positive conditions.

2.3.2 On-Site vs. Virtual Workspace Usage by Country, Industry and Education

When it comes to the actual workplaces, leading organizations worldwide share a history of competing over top-notch office locations and spaces to attract employees and support operations (De Lucas Ancillo et al., 2020), with employees in Europe only occasionally, if ever, working from home (Reuschke & Felstead, 2020). Such work from home had in most cases been subject to flexible, informal agreements between the employer and its employees, and commonly intended to serve as a means of motivation (Reuschke & Felstead, 2020). On a country-level comparison, northern European countries were already fairly accustomed to such home office agreements, with 41-60% of their workforce having worked from home at least once in 2018. In contrast, southern nations – and surprisingly Germany – maintained a

low 21-30% home office score (Eurostat Labour Force Survey 2018, as cited in Reuschke & Felstead, 2020). In fact, the German Federal Ministry for Economic Affairs and Energy attests in their 2021 report on digitalization that Germany maintained a strong presence culture and compulsory workplace attendance in many companies prior to COVID-19 (Bundesministerium für Wirtschaft und Energie, 2021, p. 6). Adding to it, the overall capabilities to allow working from home differ substantially across industries and companies: “low-skilled, high-service, labor-intensive work is less likely done from home” (Reuschke & Felstead, 2020, p. 209), whereas jobs in higher skilled, better educated fields like the financial sector, professional services, and technical occupations would generally stand a greater suitability for home-office workplaces (Reuschke & Felstead, 2020). Likewise, and as alluded to as part of the introduction, small and medium-sized companies did often neither require nor maintain the technical capabilities for virtual working as compared to their multi-national counterparts (Davenport & Prusak, 1998, Bley et al., 2016; Giotopolous et al., 2017; Ashrafi & Murtuza, 2008).

2.3.3 Covid-19 Pandemic Impact and the New Normal Workspace

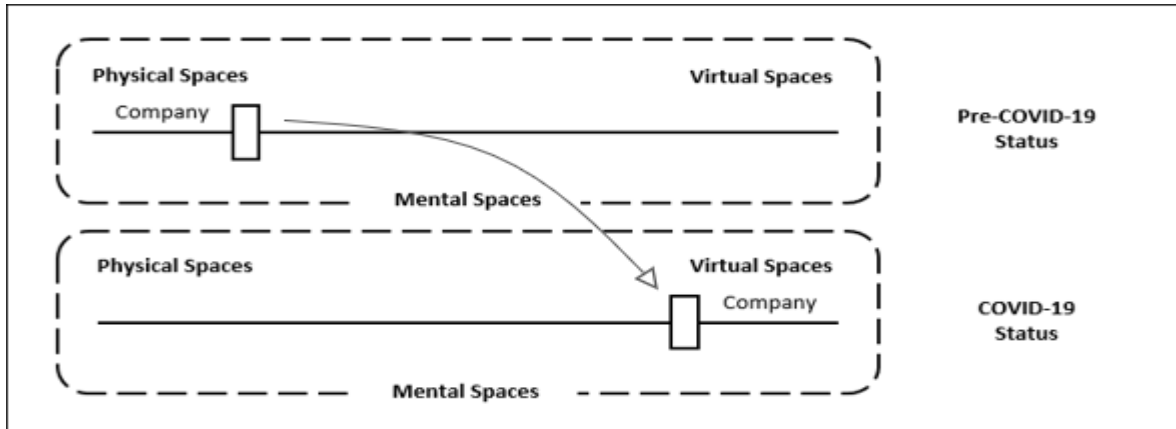
In early 2020, the outbreak of a new form of virus was noted in the city of Wuhan, China. This virus, later found to have its roots back in 2019, was dubbed CORONA VIRUS Disease 2019, or simply COVID 19. An alternative denotation refers to this virus as ‘Severe Acute Respiratory Syndrome – Corona Virus 2’, or SARS-CoV-2, hence pointing at potential patient health issues reaching from mild flu symptoms to severe respiratory problems and potential death as a result (Cirrincione et al., 2020). In the globalized environment of today, this virus not only spread across China at rapid pace, but eventually and massively affected the entire World (Cirrincione et al., 2020).

While a fair degree of uncertainty prevails regarding the exact transmission routes of COVID-19, experts have verified the virus to be predominantly transmitted by air as well as via direct and indirect personal contact (Cirrincione et al., 2020). In order to minimize the likelihood of being exposed to COVID-19 it has thus been advised by virologists, or even mandated by governments like Germany, to limit personal interactions and business travel and instead work from home wherever and whenever possible (Federal Ministry for Economic Affairs and Energy, 2017; Die Bundesregierung, 2021). In other words, the emergence of COVID-19 has meant a “massive, abrupt, and mandatory switch to work-from-home” (Kniffin et al., 2021, p. 72).

The following figure intends to depict this prementioned, forced transition within one simple visualization.

Figure 1

Knowledge Spaces' Shift as a Result of COVID-19 Pandemic Restrictions



Note. Own compilation based upon Nonaka et al. (2000) and Kniffin et al. (2021)

2.4 Virtual Knowledge Management Best Practices

Unlike teams interacting in physical spaces, Warkentin et al. (1997) find that virtual teams would be less successful. One obvious disadvantage of virtual teams is the lack of physical interaction in which work-related and non-work-related information is shared, verbal- and non-verbal cues can be exchanged, and spontaneous communication and informal relationships are naturally established (Cascio, 2000; Zakaria et al., 2004). This person-to-person interaction is said to give rise to mutual understanding and trust as well as a sound comprehension of acceptable corporate behaviors and culture – essential foundations for creating and transferring knowledge (von Krogh et al., 1997; Nonaka et al., 2006).

The above considerations consequentially lead to a dichotomy in terms of managing tacit and explicit knowledge in a virtual environment. As codifiability and the context-independent comprehension of all interacting parties is representing the underlying idea of explicit knowledge, the latter remains relatively easy to share and manage via suitable ICTs. On that same note, however, tacit knowledge proves to be utmost difficult to develop, share, manage and maintain through means of ICTs (Al-Qdah et al., 2018). Following this line of argumentation, three fields of action appear particularly expedient for optimally supporting knowledge management in virtual spaces:

- Transformational Leadership and Knowledge Activism
- ICT Tools and Processes
- Training

Transformational Leadership and Knowledge Activism

According to Nonaka, the leadership of a company, department, or team entails the ultimate responsibility to enable an appropriate context for knowledge creation and management (Nonaka et al., 2006). While there is an impressive bandwidth of leadership types and definitions existing in contemporary literature (Yukl, 2013; Hislop et al., 2018), the concept of transformational leadership appears to stand out for knowledge management in virtual spaces. Transformational leadership is essentially concerned with considering the needs of subordinates while simultaneously motivating, inspiring and persuading them towards a joint vision or purpose (Zakaria et al., 2004). The organizational buy in into such vision, in turn, facilitates all modes of knowledge creation and management (Nonaka et al., 2006). Transformational leadership is thus well suited for unstable, dynamic, and innovative environments (Yukl, 2013, p. 315), as may generally be attributed to software development and IT companies.

Knowledge Activism

But enabling context does not necessarily have to be created by executive leadership and managers alone. This is where the concept of the knowledge activist comes into play. The knowledge activist assumes "particular responsibility for energizing and coordinating knowledge creation efforts throughout the corporation" (von Krogh et al., 1997, p. 475). He or she does so by spanning across company-internal boundaries and hence encountering an array of ideas, questions, problems, and the like. The knowledge activist then unleashes knowledge creation initiatives and ensures successful employee cooperation (von Krogh et al., 1997). Strategists, in this regard, would be predestined to also act as knowledge activists (von Krogh et al., 1997, p. 480).

ICT Tools and Processes

Undoubtedly, an entire bandwidth of ICTs is existent in support of the creation and management of organizational knowledge (Nonaka et al., 2006; Hislop et al., 2018). As already alluded to, managing explicit knowledge through ICTs is considered unproblematic

and – given according business synergies – used in most modern companies in the form of databases, repositories, and the like (Hislop et al., 2018; Earl, 2001). Tacit knowledge, on the other hand, is far more difficult to manage (Al-Qdah et al., 2018). The complexity of the latter demands sophisticated ICTs, while its multifaceted nature simultaneously points at an appropriate mixture of channels. The mixture itself is subject to the knowledge management strategy derived e.g. from the unique conditions of every individual organization (Nonaka & Konno, 1998; Earl, 2001).

Table 2

Richness of ICT Channels in Terms of Tacit Knowledge Management

ICT Tool	Richness of Channel
Videoconferencing	High
Telephone	Medium
Social Networks	Medium
Document-Sharing System	Medium
Electronic Forum	Medium
Chat Room	Low
E-Mail	Low

Note. Modified from Al-Qdah et al., 2018, on Multi-National Corporations (MNC).

According to this MNC study, however, even the most skillful blend of advanced ICT cannot substitute physical person-to-person interaction in its entirety (Al-Qdah et al., 2018). Adding to it, successful virtual knowledge management initiatives require routines and processes to ensure the continuous participation of employees (Gevorgyan & Ivanovski, 2009). Along those lines, one contemporary and particularly renowned methodology is the agile paradigm. Agile is encompassing planning meetings, daily stand-up and reporting meetings, joint review meetings, and retrospectives to encourage intra-team knowledge exchange (Santos & Goldman, 2012, p. 4). The most commonly applied agile process is ‘Scrum’. It empowers the self-organization of teams and is therefore especially suitable for use in innovative, fast-paced, and complex environments like software development (Rubin, 2012; Takeuchi & Nonaka, 1986). Given the diversity of organizations, ‘Scrum Masters’ are typically

established to serve as agile coaches for their teams and ensure the development and continued advancement of optimal processes as well as the removal of potential impediments (Rubin, 2012).

Training

For any ICT to unfold its full virtue, it requires adequate skills of the persons utilizing it. It goes without saying that capable, large-scale, and/ or complex ICT systems would presuppose apposite training (Hansen et al., 1999). In terms of the virtual environment, however, training should not only concern the bare development of software skills but likewise attend to the particularities of managing an anonymous environment where hand gestures and body language may not, or only partially, be available (Cascio, 2000).

As a final note as part of this section, prior empirical research on virtual teams' knowledge management appears to have focused almost exclusively on Multi-National Corporations. This seems logical as SMEs, particularly those with a distinct physical presence culture, neither had the same multi-national and multi-office operational needs as MNCs nor did they ever encounter such forced virtualization as in the case of the COVID-19 pandemic restrictions. Hence, two factors divert from these earlier studies: firstly, cultural and language barriers/ differences tend to exist in MNC settings, and secondly teams in MNCs had not typically worked together in joint office environments over extended periods of time.

2.5 Summary

The dichotomy between tacit and explicit knowledge serves as a foundation to knowledge management. Hansen et al.'s (1999) strategy framework builds upon this dichotomy, thereby providing a particularly simple tool to assess knowledge management at a company and department level, as well as distinct proposals for action. However, as Nonaka et al. (2000, 2006) expound, knowledge requires a spatial context to even exist (ba). This context can be of physical, virtual, or mental nature, or any combination thereof. As a result of the COVID-19 pandemic, companies in Germany and abroad were forced to virtualize their operations – an environment where particularly tacit knowledge proves hard to convey and sustain. The last section of this theoretical framework therefore tried to uncover according challenges and provide select best practices and considerations in the field of virtual knowledge management.

3 Research Design

The following section describes the research design for this Master thesis. The approach was based upon the aim as set forth across Section 1 ‘Introduction’ in combination with the insights derived from the ‘Theoretical Framework’ in Section 2.

3.1 Research Strategy

The following explanation of the research strategy was divided into four sections. That is, the repetition of the research question (*Question*) from Section 1 as the basis to this academic strive, the conversion of the individual components of this question into actionable items (*What*), the research approach as an immediate, causal derivative thereof (*How*), and finally an explanation to underline the choices made (*Why*).

The research question (*Question*) as formulated in Section 1 is reading as follows:

“How have COVID-19 workplace restrictions affected knowledge management and ICT utilization at a knowledge-intensive SME in Germany, and what according suggestions for future advancement can be developed.”

By disassembling this research question into its respective components, the following three tasks (*What*), and hence preliminary structure, naturally arose:

- Assessment of KM and ICTs at a knowledge-intensive SME in Germany
- Identification of adaptations in KM practices subject to Covid-19 Restrictions
- Development of targeted suggestions for future advancements

The understanding of knowledge management at the company served as a foundation to the recognition and distinction of COVID-19-related workplace impacts, which in combination represented the basis for business recommendations.

The research question was addressed via a case study on the SME in question (*How*). The starting point of the case study was marked by the development of a clear set of primary research questions immediately addressing the individual tasks as mentioned above. These questions not only tried to follow a methodical order but were also tightly interlinked with an academically sound and proven framework (e.g. Hansen et al., 1999). Conducting an appropriate number of semi-structured (qualitative) interviews with purposively sampled

leadership staff from four key organizational areas was intended to ensure information breadth and depth. Adding to it, and as a means of triangulation, fundamental aspects of these interviews were substantiated (Olsen, 2004) through passive exploratory observations during staff meetings as well as through a brief online survey amongst employees. Accurately and objectively transcribing the interviews and observations aimed at ascertaining the quality of the study. These notes were then structured by the sequence of the research questions, assessed from different perspectives, and discussed with academic references as part of this thesis document. Last but not least, this case study utilized proven tools for interviews, observations, and the web-based survey while adhering to ethical standards as expected by the Dalarna University and governing Swedish law.

The unique, explorative, and contextual nature of the research question pointed at a case study as the optimal research format (*Why*). While definitions vary greatly amongst scholars (Gerring, 2004; Dul & Hak, 2008), a case study may generally be contoured as an in-depth examination of a single instance at a discrete point in time, led by the intent to generalize the according findings across a broader field (Gerring, 2004; Dul & Hak, 2008; Yin, 2014). As such, case studies are considered particularly suitable for gaining rich empirical data on contemporary, real-life research projects (Yin, 2014; Saunders et al., 2019) – all in line with the circumstances found to apply to this very thesis paper. The structure and sequence of the triangulation further attended to the accuracy and credibility of the results (Olsen, 2004), while still allowing to identify additional and/ or unexpected findings. The analytical approach tried to ascertain that no vital information was dropped unintendedly. And, finally, the discussion of the empirical findings from different perspectives as well as the blend of the latter with academic literature were geared towards both depth and credibility.

Given the research intent, a qualitative approach was deemed superior over a quantitative strive subject to the possibility to interact and iterate with the research participants (Saunders et al., 2019). And even more so, as the number of staff available at this SME did not suffice a quantitative approach.

3.2 Data Collection

3.2.1 Company Selection and Sampling

The selection of the company for this research was based on two main criteria. Firstly, the aim resided on a company that would meet the study requirements in terms of size, location,

and knowledge-intensity to allow answering the research question. Secondly, it was deemed vital to secure sufficient support for the entire duration, approach, and contents of this research project. As a result, the decision was made in favor of a company in which the researcher had previously been employed and continues to maintain a positive relationship with executives and employees alike. Following the scope of this case study, a purposive heterogeneous sampling method for primary research was applied. It resides within the non-probability segment and was expected to adequately support the triangulation approach with a focus on qualitative semi-structured interviews (Saunders et al., 2019; Olsen, 2004), and enriched and substantiated through exploratory observations and employee survey data.

The goal of the semi-structured interviews was not only to address all questions of the research design with diverse respondents of that same company, but to use this opportunity to gain first-hand information from executive stakeholders in command of knowledge management direction and execution. As a result, the interviews involved the Chief Executive Officer, holding accountable for the overall commercial direction and performance, the Product and Innovation Manager, responsible for the definition of key aspects of the product portfolio and according strategies, the Head of Software Development in charge of different aspects of software development and support, as well as the Head of the Sales & Marketing department.

The findings from these interviews were verified and supplemented with a total of four meeting observations at the most knowledge- and headcount-intense departments – two at Software Development, one at IT Operations & Services, and one at Sales & Marketing. These observations were aiming at the actual exchange of tacit and explicit knowledge amongst employees, as well as the corresponding utilization of ICTs. Following a general request for a meeting participation, stakeholders within the company selected meeting occasions deemed suitable to fulfil the inquiry and issued the respective invitations. The scheduled, regularly occurring team meetings which were eventually attended provided given, naturalistic, and real-world environments for analysis (Saunders et al., 2019).

Adding to it, a questionnaire was disseminated to all employees of the company with exception of those executives previously interviewed in order to avoid duplications. Addressing the entire staff was not only intended as a means of gaining further in-depth research intelligence, but likewise to broaden the reach and responses of this triangulation concerning key questions.

3.2.2 Division of Questions

The selection of questions followed the aim of this case study. As mentioned before, the division was based on the one hand on the academic framework discussed in Section 2, and on the other hand on a sequence in line with the research strategy. Following a general section dedicated to the respective participants, the next two sections were directly linked to the assessment criteria of Hansen et al.'s (1999) knowledge management strategy framework. Building upon this foundation, the fourth section pointed at the ICTs in support of knowledge management, the impact and management of Covid-19 workplace restrictions, office space utilization aspects, and stakeholder and employee recommendations for future advancement. The last question, finally, was ideated to ensure that no relevant information had been missed during this exploration.

Table 3

Division of Questions (Overview)

ID	Questions	Interview	Questionnaire	Observations	Reference
P1	Name. What is your name?	x			For conversational purposes only
P2	Age. What is your year of birth? 1946-1964, 1965-1980, 1981-1995, 1996 and younger	x	x		Cox, 2016
P3	Gender. Which gender do you most identify with?	x			
P4	Education. What is the highest educational degree you have completed?	x	x	x	
P5	Department. Which department are you working for?	x	x	x	
P6	Job Title. What is your official job title?	x			
P7	Job Responsibility. What are your primary responsibilities and duties?	x			
P8	Company Tenure. How long are you with the company and its legal predecessors?	x			Product & Innovation Mgr.
Hansen et al. (1999) Framework - Business-Knowledge Link					
H1	Standard or Custom Portfolio. Are the products/ services/ solutions of your company predominantly of standardized or customized nature?	x			Hansen et al., 1999, p. 115

H2	Mature or Innovative Portfolio. Is/ are the core component(s) of the products/ services/ solutions of your company predominantly of mature or innovative nature?	x		(x)	Hansen et al., 1999, p. 115
H3	Explicit or Tacit Knowledge. Do you and your colleagues predominantly rely on explicit or tacit knowledge to solve (complex) problems?	x	x	x	Hansen et al., 1999, p. 115
Hansen et al. (1999) Framework - HRM Implications					
H4	Rewards. What incentives are put in place for knowledge sharing and management, if any?	x		(x)	Hansen et al., 1999
H5	Training. What kind of training is provided for knowledge sharing and management?	x			Hansen et al., 1999
H6	Hiring. Are you hiring rather experienced or unexperienced staff?	x			Hansen et al., 1999
Various Authors – COVID-19 and Virtual Knowledge Management					
I1	Knowledge Management via ICTs. How do you typically create/acquire, share, store, and apply knowledge; and which according ICTs do you commonly utilize?	x	x	x	Modified from Hislop et al., 2018
I2	Covid-19-Induced Virtualization. Have the Covid-19-Pandemic based workplace restrictions resulted in changes and/ or challenges in terms of knowledge management?	x	x	x	Nonaka et al., 2000, 2006
I3	Virtual Knowledge Management Leadership. Following Covid-19-Pandemic based workplace restrictions, what has leadership/ your team done to create positive conditions for virtual knowledge sharing and management?	x	x	x	Nonaka et al., 2000, 2006
I4	Knowledge Management & ICT Recommendations. What would be your recommendations to improve knowledge management ICTs at your company?	x	X		
I5	Pre-COVID-19 Physical (Office) Space Utilization. How many working days per week on average have you come to office prior to COVID-19 (e.g. 2019)?	(x)	x		
I6	Post-COVID-19 Physical (Office) Space Utilization. How many working days per week on average have you come to office since COVID-19?	(x)	x		
I7	Physical (Office) Space Utilization Reasons. If you come to office/ would come to office in future, what would be your typical reasons for doing so?	(x)	x		Nonaka et al., 2000, 2006
Closing Question					
C1	Final Question. Can you think of anything I might have forgotten to ask, but would be a valuable addition to the above?	x	x		-
Legend: x means question was included, (x) means question was addressed indirectly, partially, or through 3 rd party input					

3.3.3 Interview, Observation, and Questionnaire Execution

The employees of the researched company were informed in advance by their management about the topic of the study and the associated triangulation by means of interviews, observations and a questionnaire. As expounded in section 3.2.1, the semi-structured interviews have served as the primary research method within the triangulation, with passive, exploratory meeting observations and the questionnaire intended to bolster the respective leadership input with real-life perspectives and employee insights.

Interviews

Saunders et al. (2019) recommend proper preparation for semi-structured interviews. Such preparation would encompass the development of “interview themes and supplying information to the interviewee before the interview” (p. 451), as well as the selection of an appropriate location, amongst other aspects.

Adhering to the above recommendation, an interview guide and a survey introduction had been developed. Apart of supportive structure for the researcher, both tools also provided essential introductory information to the interview participants including but not limited to:

- Brief personal introduction of the interviewer (where not familiar from prior employment)
- Outline of the purpose of the research
- Explanation of KM and its delineation from data and information management.
- Explanation of the term Information and Communication Technologies (ICT)
- Explanation of the terms tacit and explicit knowledge

Concerning the location, all interviews have been conducted virtually via the Dalarna University Zoom system or the company’s Microsoft Teams (hereinafter: ‘MS Teams’) application. The interviews with the CEO and the Product and Innovation Manager were conducted in English language, whereas the Head of Sales and Marketing and the Head of Software Development preferred German instead. The four individual sessions endured between 45 and 75 minutes and were initially documented through video recordings and scratch notes. In a follow-up step, video findings and meeting notes were combined into proper interview transcripts and – where the interviews were executed in German language – translated accordingly.

Observations

The aim of the observations was to explore “what people do and how they interact” (Saunders et al., 2019, p. 378). Accordingly, this method was ideally suited to validate and supplement the statements made by the interviewees in a real world environment. The requested participation in established, regularly occurring meetings embodied the benefit that the activities of the informants remained independent and thus unadulterated from the interests of the researcher. Along those same lines, the passive role of the researcher as the ‘observer-as-participant’ further contributed to the naturalistic setting (Saunders et al., 2019), while the experience from prior employment at the company supported contextual comprehension.

In terms of coordination, stakeholders within the company selected the meetings they deemed appropriate to satisfy the aim, pro-actively gained employee consent, and issued the corresponding invitations to the observer for the following occurrences:

- Three ‘Daily’ team meetings in the IT Operations and Software Development departments, lasting 15 minutes each, and comprising 16, 16 and 12 informants
- One weekly team meeting of 45 minutes length in the Sales and Marketing department with a total of 10 informants

It should be noted at this point that the Sales and Marketing department did not seem to conduct daily team meetings. In contrast, major conventions of the IT-related teams were not scheduled during the period of this thesis exploration. All observations were attended virtually through MS Teams, with the language of these standard team appointments being German. Like the interviews, the observations were video recorded and, together with the according scratch notes, documented and translated as part of transcriptions.

Questionnaire

Questionnaires are not ideally suited for use in a qualitative, exploratory study. Nevertheless, their application as part of a case study can be recommended in order to generate additional details and bandwidth (Saunders et al., 2019) – as desired in this instance.

For this purpose, and based on an excerpt from Table 3, a web survey comprising a total of 12 questions was created in the renowned host platform 'SurveyMonkey'. The latter represents a survey specialist catering to more than 17 million active users worldwide and

adhering to the EU General Data Protection Regulations 'GDPR' (SurveyMonkey, n.d.). The survey was accompanied by an introductory cover letter expounding on the number of questions, the expected duration, as well as the terms knowledge, explicit and tacit knowledge, and ICT. The active link to the questionnaire was disseminated by the CEO to all employees with the exception of the previous interview respondents, while all of the 14 eventual responses were maintained by the researcher in the SurveyMonkey tool.

Sequence

As with regards to the sequence, the interviews as well as the observations were conducted first, with the questionnaire trailing by approximately 1.5 weeks. The rationale behind this temporal offset was to comprehend initial findings and allow for refinements and expansion upon prior outlines. As a matter of fact, questions I5 – I7 have been added during this intended delay to cover aspects of physical space utilization. Adding to it, and against initial intentions, the amount of questions in section one of the questionnaire (P1 – P8) had to be limited to a total of three questions following a request by one of the respondents to avoid traceability in light of the size of the respective departments. Data concerning employee company tenure was instead provided through the Product and Innovation Manager, who is with the company since its inception.

All interviews and observations have been conducted by the researcher in person. Data accrued through the questionnaire has been derived directly from SurveyMonkey.

3.3 Data Analysis

King and Brooks (2017, p. 26) propose a six-stepped sequence of analytical actions, beginning with the familiarization with the data, a preliminary coding exercise, clustering of the information, the creation of an initial template, application and development of the template across all information collected, and finally the interpretation and discourse thereof.

This research has followed along these lines such that all manually transcribed information as well as the questionnaire data have been transferred into a single Microsoft Excel template. The template was shaped in line with the basic structure and sequence of the 'Division of Questions', allowing to compound the findings of the individual triangulation components.

The actual analysis then entailed the review and comparison of the entries from different perspectives as well as an interpretation in reference to the prior theoretical framework.

3.4 Data Reliability and Validity

Albeit triangulation was foreseen for this case study, the methodical focus resided on the semi-structured interviews. Saunders et al. (2019, p. 447) name the following issues as potential detriments to data quality in semi-structured interviews:

- Dependability/reliability
- Different forms of bias
- Cultural differences
- Generalizability/ transferability
- Validity/ credibility

The interviews conducted as part of the case study have been unique in terms of time and personnel assembly. To still maintain a high degree of reliability/ dependability, this thesis paper provides detailed information concerning the approach and methods selected (Saunders et al., 2019). Different forms of bias may generally jeopardize data quality, including participation bias and interviewer bias (note: the interviewer has been a prior employee of the SME). In order to avoid such bias from affecting the study, the interview participants have been selected (a) on purpose and in tight alignment and coordination with the CEO of the SME, and (b) the selection of observed meetings was conducted by company stakeholders. The interviewer bias was mitigated in parts through the semi-structured format of the interview questions as well as by the fact that no direct interference was possible during both the observations as well as the online survey. Major cultural challenges were not expected nor occurring during this research due to the fact that the company was located in Germany without foreign subsidiaries, and the interviewer as a previous employee has been aware of the company culture. In terms of mitigating possible generalizability/ transferability issues, the questions were linked closely – at times even word-by-word (H1-H6, “tacit and explicit knowledge”) – to existing theory and academic frameworks, thereby further eliminating bias, interpretation errors and deviations. Data quality shortfalls arising from validity/ credibility issues were overcome through triangulated data sources (Saunders, 2019) with probing of interview data and validation through observations and survey responses.

3.5 Ethical Research Aspects

As far as ethical research aspects are concerned, this thesis has been executed in accordance to 'The European Code of Conduct for Research Integrity (All European Academies, 2017) in general, as well as a mutual Non-Disclosure Agreement (NDA) for the duration of the research engagement between the SME and the researcher in particular.

Following the NDA, all sensitive personal and business information has been anonymized prior to release to third parties as is the case for the initial thesis drafts, interim coursework deliveries, and the final document. In addition, all traceable personal and/ or confidential business information including videos is to be deleted from the researcher's storage in accordance to the NDA within a pre-defined timeline.

In terms of the actual interviews, observations, and the questionnaire, all research participants have received pro-active briefings including an outline of core ethical aspects and were asked for their consent prior to the research being exercised. Furthermore, permissions for video recordings of both the actual interviews as well as the observations were requested by the researcher and obtained accordingly.

4 Empirical Findings

This section presents the empirical findings gained from the triangulation research. In a first step, the company is introduced, whereby the further course of this outline is following the order of the questions from Section 3.2.2 ‘Division of Questions’. The latter start with demographic data as well as the roles and responsibilities of the interviewees to then enter into a distinct knowledge management assessment and the question of how the COVID-19 pandemic workplace restrictions affected knowledge management.

4.1 Company Profile

The company addressed for the purpose of this master's thesis is located in the German metropolitan region of Rhine-Main and engages a total of 42 employees. It was incorporated in 2001 and has since grown into an established IT solution provider in the field of business-to-business logistics services. As part of its business model, the company develops, sells and supports a portfolio of software solutions that range from Application Programming Interfaces (API) and small-scale server/software applications to extensive custom and white-label programs for large customers. In terms of customer numbers, the company serves a total of over 5000 clients in various fields of industry, banking, and health care sectors, all of which exclusively based in Germany.

The office itself is situated in a modern multistorey building at the outskirts of a highly frequented industry and business district. The associated office space is spread across two floors and subdivided into individual rooms for the executive leaders, open plan offices with personal desks for the employees, numerous silent working and small and large meeting rooms as well as dedicated interaction areas (e.g. for software development teams) and common, coffee, and kitchen areas.

The basic organizational structure of the company is divided into the four departments (IT)Operations & Services, Software Development, Finance & Human Resources, and Sales & Marketing. Each of these departments is headed by a manager who, like complementary executive positions for Product & Innovation Management, Technology & Change and Quality Management, report to the Chief Executive Officer. In terms of headcount by department, a total of 15 of the non-executive employees are linked to Software Development, 9 to (IT)Operations & Services, eight are linked to Sales & Marketing, and three to the Finance part.

4.2 Demographics and Responsibilities

The following section attends to the demographics of the four interviewees and 14 questionnaire respondents, as well as the specific roles and responsibilities of the interviewees. Adding to it, this data has been enriched through statements by the Product & Innovation Manager, who represents the second longest employed staff, on company tenure of the entire workforce and employee gender.

Table 4

Participant Demographics

ID	Questions	Chief Executive Officer	Product & Innovation Mgr.	Head of Sales & Marketing	Head of SW Development	Survey	Company Totals
P2	Age (Range)	1946 - 1964	1965 - 1980	1965 - 1980	1965 - 1980	3 x 1946 – 1964 8 x 1965 – 1980 3 x 1981 - 1995	Unavailable due to data protection and traceability concerns
P3	Gender	Male	Male	Male	Male	Mixed	31 Male, 11 Female
P4	Education	Ph. D.	Master	Main School	Master	1 x PH. D. 7 x Master/ Bachelor 6 x Middle & High School	Unavailable due to data protection and traceability concerns

With regard to the age of the respondents, most of the questionnaire participants and three interview partners reside within the age cohort of Generation X (1965–1980). The Baby Boomer generation (1946–1964) accounted for a total of four respondents including the CEO, while only three respondents belong to the Generation Y group. As already expounded in Section 3, it was not possible to evaluate information on the entire workforce subject to data protection and traceability concerns.

In terms of gender, all executive leadership interviewees were male. However, a mixed picture emerged with regard to the questionnaire respondents. Overall, there are 31 men and

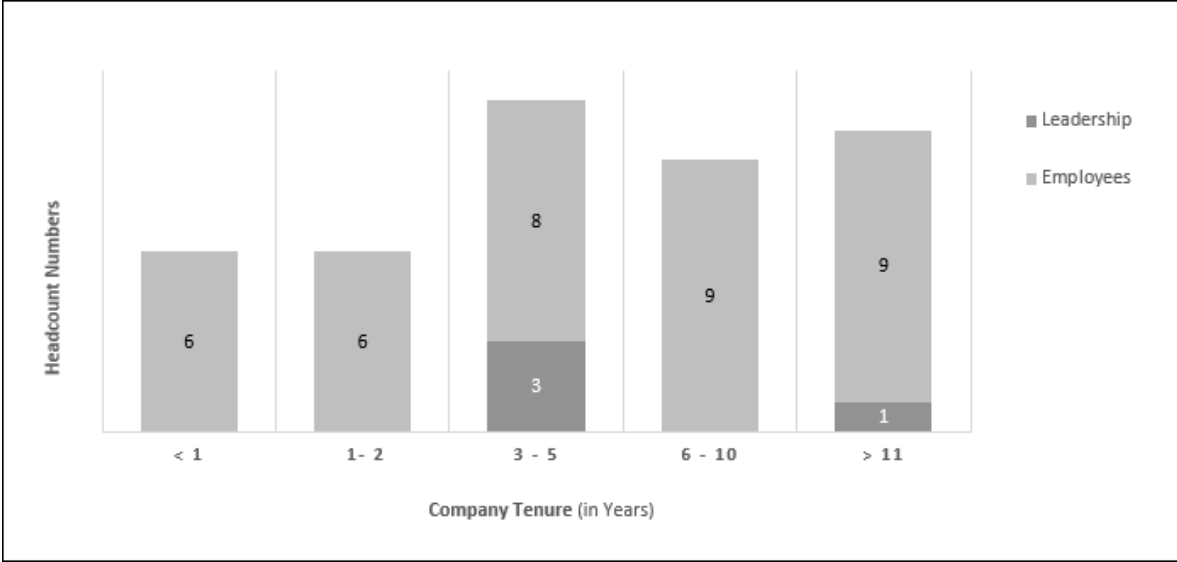
11 women employed at the company, with five of the women working in the Sales & Marketing department, one in Finance, and the remaining five being situated in the (IT)Operations & Support and Software Development departments.

A further interesting set of details has been identified in the area of education. While the aforementioned data protection considerations also limited this assessment, the following picture emerges with regard to the total number of respondents: three out of four of the interviewed executives completed a university-type education, with the CEO being a Doctor of Philosophy, or Ph. D. The questionnaire respondents reveal a mixed picture encompassing yet another Ph. D. degree, seven university degrees and six middle and high school degrees. While this range appears balanced at first sight, the Sales & Marketing department sticks out with three middle school degrees and only one academic education completed.

Another interesting data point relates to the company affiliation of the workforce. There is again a clear spread visible, with company tenures in excess of three years clearly representing the majority.

Figure 2

Company Tenure – Leadership Interviewees & Employees (P8)



Of the four interviewed executives, all have been with the company for three years or more, while the Product & Innovation Manager having been employed for around 18 years at the time of the interview. Only six employees were hired in the 12 months prior to this research

project – one in Sales & Marketing, one in (IT)Operations & Services, two in Software Development, one in Finance, and one linked to an executive administration position.

Job Responsibilities – Interview Participants (P6 & P7)

As the interviews have served as the primary means of the research triangulation, and for reasons of thesis scope, aim, and time limitations, this outline on job responsibilities will focus exclusively on the four executive leaders interviewed. The CEO, to begin with, regards himself in charge of “running the company”, including the definition of the company strategy together with his teams, defining the according product portfolio as well as ensuring the appropriate organizational structure. Adding to it, he holds ultimately accountable for questions of disciplinary leadership and the business financials of the company. The second interview partner in this outline, the leader of Product & Innovation Management, does not encompass such disciplinary responsibilities. Instead, he is spanning across all internal departments including Sales & Marketing, Software Development, (IT)Operations & Service, as well as administrative support functions to drive product innovation and portfolio strategy as well as associated business, process, and system optimization initiatives. The head of Software Development considers himself in charge of translating the innovation and portfolio strategy into target parameters for the software development teams. As such, he holds also accountable for the respective organization, operations, and employees of the department. The head of Sales & Marketing, as the name already implies, is leading market research, definition of sales targets and reach, marketing initiatives to prepare the market, and product placement and sales. Like the head of Software Development, his role entails disciplinary responsibilities for his team.

4.3 Knowledge Management Assessment

This sub-section follows the order of the 'Division of Questions' as set forth in section 3.2.2. (H1 – H6), utilizing Hansen et al.'s (1999) framework for the assessment of the business-knowledge link and HRM implications. The answers were given individually and independent from other respondents and are grouped together in a meaningful way to support the question and reflect perspectives. Quotations and statements considered to be of particular value for the purpose of this thesis paper, or which elegantly synthesize the essences of the respective sub-sections, are indented for enhanced reader comprehension.

Standard or Custom Portfolio (H1)

The CEO explained that the company would be in a “state of transition” at present, stating:

“We are coming from a history of fully customized products yet orienting towards a more standardized portfolio”.

Along those lines, the Product and Innovation Manager alluded to the present portfolio featuring a diverse set of products and services to suffice over 5000 clients. The main revenue generator, however, would be a complex IT application catering to less than 50 large-scale customers, 2/3 of which receiving completely customized solutions. From a similar yet different perspective, the Head of Software Development considered 60-70% of the current portfolio already being standardized, with 30-40% remaining in customized format. The Head of Sales and Marketing, while not estimating percentages, also attested to the majority of the offerings being standardized at the time of the interviews. According to both the CEO as well as the Product & Innovation Manager, the future portfolio should “avoid deep customizations” and instead be based upon a single core software platform with ‘customizations’ only to occur in the form of micro-services at the configuration level.

Mature or Innovative Portfolio (H2)

Both the CEO as well as the Product and Innovation Manager admitted that such distinction between a mature and innovative product portfolio would not be easy to make. On the one hand, the company and – with it the product portfolio – is on the market since 2001 and has hence reached a fair level of matureness. On the other hand, the Product and Innovation Manager noted:

“The company aspires uniqueness through continued innovation.”

Well in line with this statement, the CEO attested to the company launching new product functions and features on a regular basis, with three major software releases being issued every year. Intelligence gained from observing three meetings across the technical departments underlined ongoing support for existing products, services, and functionality, whereas two major teams were mainly concerned with new development tasks and related issues. Furthering the above, the Head of Sales & Marketing posited that the “journey ahead is unknown and hence requiring the company to stay innovative”. Future innovations, as the Product & Innovation Manager explained, would most probably stem from a combination of

assets including but not limited to the software engine, its features, and functions, and supporting services.

Explicit or Tacit Knowledge (H3)

On the question concerning which type of knowledge – explicit or tacit – would typically be utilized to address problems across the company, all four executive interview participants responded that both types would be needed; and that it would in fact be subject to the respective context or problem to decide which of the two would suit best.

On a general level, the CEO posited that e.g. market and portfolio decisions would tend to be of tacit nature, meaning based on experience. Market research initiatives, however, would also strive for supplementary data and information. Similarly, he elucidated that the knowledge how to build software within the Software Development department would typically be of tacit nature. The Head of Sales & Marketing independently complemented these CEO considerations by explaining that certain industry and customer knowledge would principally be based upon experience. In contrast, technical challenges e.g. from medical companies or organizations would prompt his team to rely upon existing explicit knowledge in the form of guidance documents, manuals, and the like. In the Software Development department, according to the Head of Software Development, colleagues would mainly contribute and share knowledge and experiences gained from, or required in, projects. The observation of two online daily team sessions confirmed this perspective, with substantial collaboration and knowledge exchange occurring through the ICT MS Teams. Nevertheless, the teams also utilized log files and graphics to structure and support the interactions.

The Product & Innovation Manager explicated that only a few years back, a certain individuals' leaving would have endangered the company's survival. Because of this imminence, the company has since been eager to “make knowledge explicit and independent of people”, while simultaneously “keeping bureaucracy in check”. Still, the Head of Software Development noted that “IT is a highly dynamic environment where knowledge doubles every two years”. Because of these circumstances, he further explained that “a static approach to knowledge would not be suitable”. Or as the CEO contended:

“One cannot simply relax and rely on what one has learned and experienced before.”

New and complex problems would require the building of knowledge, but he would also aim at hiring experienced staff to quickly supply missing knowledge, and even consider external resources and networks to gain access to industry and specialist knowledge.

Interestingly, 11 of 12 questionnaire respondents (note: two waived) selected tacit knowledge to answer this question, with one explaining in a separate field that both types of knowledge would apply.

Rewards (H4)

As with regards to the topic of rewards and incentives for sharing knowledge, the CEO expounded that “you can hire people, but the art is to spread the knowledge and support it continuously”. However, he also noted that there would not be any form of explicit incentives for knowledge sharing and management – a fact confirmed by all four executive interview participants. Instead, the interviewees pointed at targets and deliverables as indirect incentives of knowledge exchange. The Head of Sales & Marketing explicated that targets would be key to sales, and that every single target would require knowledge. In his team, targets are even highlighted through dashboards which in turn serve as a form of guiding framework. Knowledge sharing and management would then be crucial to achieve these targets. Or as the CEO put it: “You cannot deliver without sharing knowledge”.

Testifying to these statements, the Product & Innovation Manager noted that the so-called Scrum (Agile) process in software development would feature a breadth of rules, tuned to aid tacit knowledge exchange. Adding to it, the Head of Software Development referred to small celebrations initiated by the leadership for successfully completed projects. Under COVID-19 conditions, this could e.g. be a lunch pizza for employees in the home office, paid by company management. Furthermore, all employees who attend a training would be requested to present and share their new knowledge with their colleagues, who in turn tend to respond with appreciation. In general, the Head of Software Development recognizes:

“A culture of appreciation for knowledge sharing”

A notion of this appreciation could clearly be sensed throughout the daily meetings in both IT-related departments for the exchange of knowledge as well as help granted to resolve challenging tasks. Team members verbally thanked their colleagues for input and guidance received.

Training (H5)

The CEO began his answer to this query in humoristic fashion, indicating that the company would not tend to provide extended trainings. In fact, he continued that formal trainings would only occur where deemed necessary. His leadership team underlined this perspective by adding the terms ‘pragmatic’, ‘specific’, and ‘limited’ to describe training initiatives at the company. More specifically, however, it was noted that it would typically be on leadership to identify training needs and organize according measures. The latter could entail the hiring of external trainers to educate teams in new and complex software matters yet could likewise span across numerous internal measures. One example for an internal measure would be the ‘How-to-Know’ initiative in the Software Development team, where every employee is requested to train his peers. The employee could select the training measure he/she deems most appropriate and convey knowledge – e.g. via live presentations – on software functions, features, use cases, and the like. One training concept that was attempted, but apparently failed due to missing employee buy-in, was the joint development of software code amongst two peers. Last but certainly not least, the Agile methodology for software development was pointed at multiple times, entailing informal training through joint development code reviews, explanations of functionalities, sharing of development considerations and knowledge etc. Agile also represents a ‘managed framework’, which, as the CEO described, involves guided interaction and moderation through a knowledgeable ‘Scrum Master’. This interaction, exchange, and learning could be confirmed via the IT-department observations, where screens were frequently shared to aid colleagues’ comprehension, systems and even best practices were explained and discussed, and explicated knowledge in the form of documents, manuals, and their locations were addressed. As for Sales & Marketing, trainings are generally provided by the Head of the department. Trainings would be executed e.g. when new industry branches were being addressed, where data and information was gathered, accrued, and documented first, with the team thereafter being briefed on this new knowledge in terms of document location and specifics. The Head of Sales & Marketing noted:

“The focus of training resides on staff comprehension of knowledge at hand”

Training measures beyond the above company approach are considered by the Product & Innovation Manager to place a large burden on knowledgeable staff and hence create resource issues.

Hiring (H6)

According to the CEO, the company hires experienced staff only. The company had earlier been forced to hire unexperienced employees due to financial constraints, but these hurdles would no longer exist. The Head of Software Development partially countered this account by noting that hiring would again be context dependent. He would:

“Hire experts in certain contexts, and novices in other”

In terms of hiring experts, the Product & Innovation Manager reiterated upon the intention to remove legacy products. The aim would be to move forward quickly with new knowledge, while the task imposes a severe degree of complexity, and internal training of new and unexperienced staff would place further strain on the team – all of which hinting at hiring experienced employees. Pursuing a fundamentally different approach, the Head of Sales & Marketing opts exclusively for unexperienced staff. His rationale grounds on previous challenges experienced with newly hired experts that “did not adapt to the team culture properly” and had to let go. He hence found young staff easier to ‘shape’ along the needs, directions, and culture of the team.

One negative aspect independent of employee experience was related to language barriers in the Software Development team, prompting the release of a recently hired Indian-born colleague.

4.4 COVID-19-Related ICT and Knowledge Management Adaptions

In line with the prior, this sub-section follows the order of the 'Division of Questions' as set forth in section 3.2.2. (I1 – H7), this time inductively researching the changes in knowledge management caused by COVID-19 workplace restrictions.

Knowledge Management via ICTs (II)

Prior to the pandemic outbreak, on-site meetings and personal interactions served as the prime means of knowledge creation and sharing, supplemented for the most part through phone calls and e-mail exchanges. Concerning documentation and application, knowledge was stored in, and retrieved from, multiple different department-owned file systems, via personal computers, Microsoft (MS) Outlook (e-mail), MS Word, and to some extent also

through Confluence (a cloud-based corporate wiki system developed by software provider Atlassian) and Salesforce (a cloud-based sales and marketing software).

Table 5

Dominant Means of Knowledge Management

Knowledge Mgmt.	Prior Pandemic	During Pandemic
Creation/ Acquisition	<ul style="list-style-type: none"> • <i>On-Site Meetings</i> • <i>Personal Interactions</i> 	<ul style="list-style-type: none"> • MS Teams meetings
Sharing/ Application	<ul style="list-style-type: none"> • <i>On-Site meetings</i> • <i>Personal interactions</i> • <i>White boards</i> • Phone • E-mail • Confluence • Salesforce 	<ul style="list-style-type: none"> • MS Teams meetings & chats etc. • Confluence incl. ticket system & Wikis • Salesforce
Documentation	<ul style="list-style-type: none"> • Multiple file systems (by dept.) • Confluence • Salesforce • E-mail • MS Word • Personal note-keeping 	<ul style="list-style-type: none"> • Confluence incl. ticket system, video recordings etc. • Salesforce
Summary	<ul style="list-style-type: none"> • Blend of virtual & physical means • Many loosely connected and/ or independent systems • Search locally/ by dept. only 	<ul style="list-style-type: none"> • Virtual means only • Few, interconnected systems • Search company-wide possible
Legend: <i>Italic font</i> refers to entries which are not immediately ICT-related. Management, in short: 'Mgmt.'		

Today, the company focuses on three core systems for knowledge creation and management, namely MS Teams, Confluence, and Salesforce. MS Teams serves as the primary ICT for team interaction and collaboration, providing functions like video conferencing, recording, screen sharing, file sharing, and group and peer-to-peer chats, amongst others. According to the Product & Innovation Manager, Microsoft has advanced both the offered features and system reliability since the beginning of the pandemic-induced global trend towards home office operations. He went on to praise the “integrational nature of MS Teams”, which would unite the earlier clutter of systems like telephone, mail, on-site personal meetings etc. into a single application, thereby improving efficiencies (e.g. less maintenance, better accessibility and usability etc.) substantially. He summarized as follows:

“A remote setup demands a tight integration of phone calls, emails, video, chats, calendar, file management, and screen-sharing functionality”.

Most every of these collaboration features were found in action for various forms of knowledge creation, exchange, documentation, and application during the observations conducted. The Atlassian Confluence system, on the other hand, had been furthered to become the principal information and knowledge base. It features a clear, delineated structure for easy employee access and comprehension and is, as the Head of Sales & Marketing attested, also integrated with the third major ICT, Salesforce, utilized by his department. He synopsized that too much information and knowledge was hosted in too many places before, and that the reduction of systems actually meant an improvement.

COVID-19-Induced Virtualization (I2)

As with regards to the impact of the pandemic-based workplace restrictions on knowledge management, the CEO shared his impression that the company “had been prepared, with COVID-19 just changing the place”. He went on to explain that employees had to get used to not having the same degree of informal communication as before, for example over a coffee in the respective office areas. In this context he recognized that they would be “missing something”, but that it would be “not too bad”. The Product & Innovation Manager explained that “the need to work from home had actually helped making people convert knowledge from tacit to explicit”. Along those lines, the Atlassian Confluence system had become ever more important to maintain control over knowledge. The same was found to be true for Salesforce, where the Head of Sales & Marketing identified efficiency gains through enhanced online documentation and team discipline. While previously knowledge was principally shared through hallway conversations, it then became available to all team members universally, a factor even resulting in more effective overall sales processes. Adding to it, and as elaborated earlier, MS Teams had now turned into the primary collaboration tool, providing chat functionalities similar to those of the popular yet predominantly privately used WhatsApp application. On that account, the CEO noted that emails had become less relevant due to them being “too static”, with no instant discussion being possible and file sharing a likewise cumbersome undertaking. Knowledge documentation benefits of MS Teams were also identified in comparison to prior physical interactions, which were “too fast for instant documentation”, and hence demanding transcriptions as a time-consuming follow-up event. Instead, meeting agendas would now be

posted on Confluence with online interactions either recorded or otherwise instantly documented and interlinked.

One stunning finding by the Product & Innovation Manager concerned the fact that their “tech guys would tend to interact more now than they were when meeting colleagues face-to-face” in the pre-COVID-19 setting. He posited that the individuals in question would dislike speaking up personally in front of others, but that they would not have issues communicating and exchanging knowledge online. Somewhat related but different, the Product & Innovation Manager attested to a “concrete feeling of interrupting people when calling them”. In this new virtual environment, this notion had led to a fascinating “new etiquette”, where colleagues would tend to think twice before reaching out; or first prompt a brief request for a conversation, asking whether it would be fine to disturb. As a result, disturbances were found to have reduced significantly.

Unfortunately, however, the new virtual environment was also found to lead to numerous detrimental effects. A first such effect concerned the knowledge management systems: while the reduction from prior “ICT-piece-meal” (quote: Product Innovation Manager) had generally been appreciated, it likewise incurred a dependability on a few major system providers. These providers, according to the Product & Innovation Manager, would update their software, move content (e.g. from on-premise to web-based), and create overlapping knowledge management-related functionality – all of which outside of the company’s control. Not to speak of the fact that basing essential company knowledge online generated intellectual property concerns. In terms of employee collaboration, exchange of knowledge was confirmed to be more complex. As the Head of Software Development formulated:

“The channel for personal contact and interaction is narrower in virtual compared to physical environments”

On the one hand, personal and informal exchange was considered to occur less frequently. On the other hand, when and where interactions were being executed virtually, they would lack crucial components of communication like gestures and/ or facial expressions etc. Further on, as was noted by a questionnaire respondent, team members would attend virtual interactions with reduced attention, “as one always tries to accomplish something else in parallel”.

Table 6*Virtualization Impact on Knowledge Management*

	Benefits	Challenges
Systems	<ul style="list-style-type: none"> • ‘ICT-Piece-Meal’ reduction • Instant virtual documentation • Unilateral knowledge access 	<ul style="list-style-type: none"> • External system dependencies • Intellectual property concerns
Collaboration	<ul style="list-style-type: none"> • ‘Tech Guys’ interact more • New collaboration ‘etiquette’ reducing disturbances • Process improvements 	<ul style="list-style-type: none"> • Narrow channel for tacit knowledge sharing • Reduced employee attention in virtual meetings • Missing social interaction
Summary	<ul style="list-style-type: none"> • Tacit-to-Explicit knowledge conversion 	<ul style="list-style-type: none"> • Social interaction ‘leaned out’

Virtual Knowledge Management Leadership (I3)

On the question of what leadership had done to create positive conditions for virtual knowledge sharing and management, the CEO explained that “he would not consider the sharing of knowledge to be a top-down thing”. Instead, employees who perform particularly well in one area would also be predestined to own this area and take leadership. He went on to postulate:

“Management may set the framework, but the present state is more democratic in comparison to before. Teams now self-organize more from bottom up and aim and structure for collaboration.”

Nevertheless, leadership at this company was found to have initiated an entire array of new and supporting knowledge management measures.

Firstly, they invested expediently into technical and human resources. Not only did they introduce MS Teams as a new and powerful collaboration platform, they also established a new Virtual Private Network (VPN) and expanded the digital bandwidth, bought powerful laptops and headsets for those employees previously without such equipment, and have ordered cameras to be delivered shortly. The latter were said to be late only due to supplier shortages as a result of COVID-19-induced society-wide demand. In terms of human resources, the Head of Software Development recently hired an experienced, pro-active Scrum Master to deal with knowledge coordination and removal of impediments amongst the team members.

Secondly, executive leadership attended to the new virtual working environment as such. The Head of Software Development, to begin with, explicated upon explanations, guidance and adjusted processes which had been provided to employees. One example along those lines would be the move from defined meetings to group sessions. While previous meetings had typically been organized with a defined set of participants, group sessions would now be even open to those not immediately part of the organizing team; or e.g. the software development department at all. These open group sessions would be intended to mirror prior physical meetings, where exchange, chatting, and personal interaction was possible, and where non-group-internal people had occasionally joined in or walked by. During the three IT-related observations, one team comprising six employees had 16 attending their daily team session, a second team of nine likewise showed 16 informants, and a third team of 10 had 12 using the opportunity to tune in. The Head of Sales & Marketing also initiated process updates subject to the sudden workplace virtualization. However, in the case of his team such alterations had mainly concerned the documentation of information and knowledge. As a result, and subject to his introduction of strict directions and processes, he found the quality and richness of his sales pipeline to have substantially improved over previous states. Further on, leadership in general established a central COVID-19 information page on Confluence, where employs would find the latest related company guidelines, moved the monthly management brief-out from the office to the virtual space, and even started sharing key outcomes of their own daily management meeting on Confluence; thereby creating a new level of internal transparency. In terms of incentives for successful project completion, the Head of Software Development alluded to joint online lunch sessions having been introduced, in which company-expensed food of choice would be delivered to the home of the respective team members through delivery services.

Knowledge Management and ICT Recommendations (14)

Although the company had successfully implemented a number of initiatives and measures to support virtual knowledge management, there are still a few points for improvement on the part of both management and employees. The CEO, for instance, recommended a further refinement of rules for the usage of ICTs in order to “ensure everyone knows where to store and/ or get which information and knowledge”. The Product & Innovation Manager added that it would not only require rules, but also according training and workshops for employees to absorb them. On the point of training, the Head of Sales & Marketing noted that with Confluence having become the central tool for knowledge management, technical and non-

technical staff would now access the same foundation. This would mean that the explicated knowledge would have to be formulated universally comprehensible – a somewhat more open-minded and sophisticated undertaking than in prior, department-specific settings. Along those lines he considered the following essential for employees:

“Know how to transfer knowledge through the right formats” (e.g. pictures, tables, text) and to find an appropriate balance between too much and not enough knowledge explicated.”

The salient identification and mental distinction by many employees between the third floor (IT-related departments) and the 7th floor (Sales & Marketing) would be another hurdle to be addressed in this context.

In any case, according to the Head of Software Development, the virtual environment would not ever be able to fully replace personal interactions. He would for instance miss vibrant whiteboard interactions, with no online tool yet providing the same richness of the person-to-person exchange (e.g. gestures, facial expressions, etc.). Questionnaire responses tuned into this comment by missing the prior degree of social interaction and proposing sessions exclusively dedicated to social interaction, which would in turn reduce the notion of otherwise disturbing colleagues by contacting them.

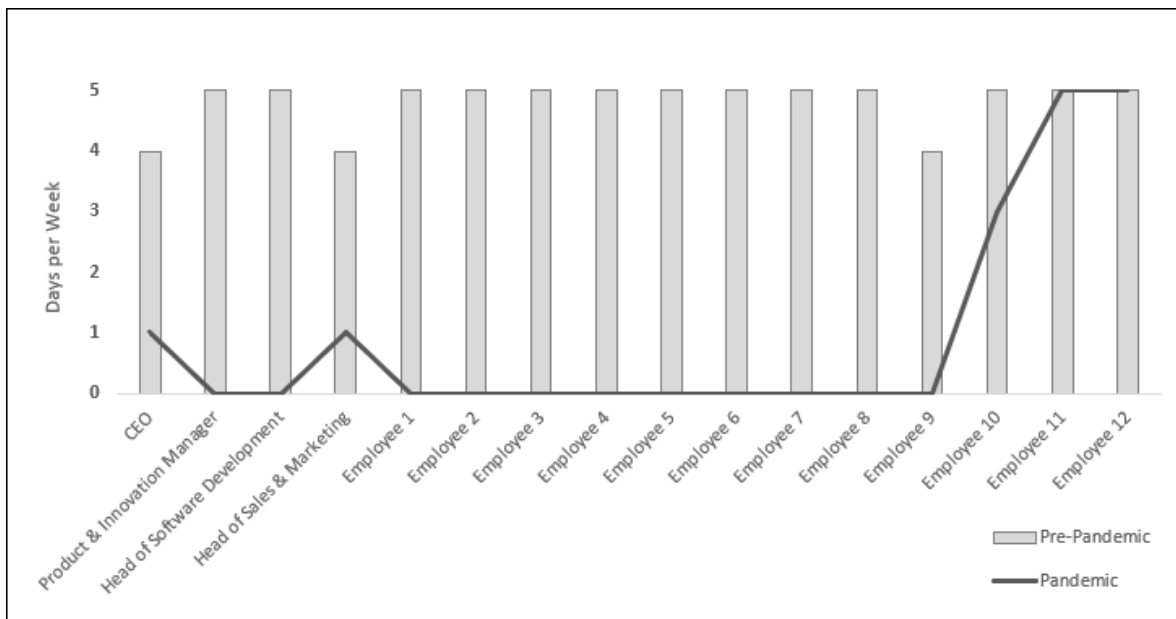
On two different notes, finally, the CEO expressed his intent to evaluate options to connect to the ‘outside world’ to gain new and additional knowledge considered valuable for his company. Secondly, given the positive overall experience from the last months under pandemic restrictions, he would not aim at a return to the prior 5 days in the office per week. He would instead invite people to come to office for two to three working days.

Office Space Utilization (15 – 17)

The COVID-19 pandemic has indeed led to significant shifts from a presence office culture to an almost complete virtual working environment. While almost all employees were previously permanently coming to office during weekdays, only a few employees have been working on site since the outbreak of the pandemic. The following figure visualizes this shift based upon executive interview participants’ and questionnaire respondents’ responses:

Figure 3

Office Space Utilization Prior and During the COVID-19 Pandemic



It should be noted that even before the pandemic the CEO was not present for five days every week due to his family being situated in a different region of Germany. Since then, the CEO has occasionally visited the company premises to look after employees who cannot work from home due to a variety of reasons including but not limited to a lack of ‘private office space’, noisy surroundings, advanced office IT equipment, or the like.

In the case of the Head of Sales & Marketing, he commutes to the office to attend to certain marketing tasks which according to him require to be discussed in person (e.g. marketing materials, adverts, etc.). Also, his team is asked to come to office one day per week at alternating weekdays and staying in separated office rooms to avoid infections while ensuring a “healthy degree of presence”.

As with regards to a future utilization of physical (office) space, leadership interviewees as well as questionnaire respondents posit the meeting and interaction with colleagues, better (e.g. quieter) working conditions, hardware maintenance, document printing, appraisals and team building as key benefits.

4.5 Supplementary Findings

This sub-section entails participant remarks supplementing their input in the aforementioned areas, or in general.

Final Question (C1)

On that point, the CEO again stretched his intention to connect the internal knowledge base to external resources not only to gain information, but to access, build, and manage further knowledge. According to him, this could for instance entail connections with universities for the exchange of knowledge. The Product & Innovation Manager expounded on the fact that an Enterprise Resource Planning (ERP) system had not been in place by the time of the interview but would be regarded a positive addition to the core ICTs as described herein under. The Head of Software Development, finally, stated that personal interaction would be crucial for the development of interpersonal relationships and friendships – he hence expressed his concerns in the current virtual setting for extended periods of time and looks forward to overcoming the limitations induced by the pandemic.

5 Discussion and Recommendations

This section intends to discuss the earlier findings in detail and from different perspectives and postulate interrelated recommendations for future advancement. It begins with sub-section 5.1, in which the general approach of the company concerning knowledge management will be addressed, with sub-section 5.2 contributing considerations on the COVID-19 induced virtualization. Sub-section 5.3, finally, will derive propositions for future advancement of knowledge management based upon the prior reflections.

5.1 Discussion on Knowledge Management Assessment

As stated above, this sub-section intends to provide a brief discussion on the knowledge-intensity of the company in question, as well as its general approach to knowledge management. In other words, this sub-section aims at setting the foundation to understand the impact of COVID-19 as set forth in the consecutive section 5.2.

Company and Knowledge-Intensity

The two initial and perhaps most fundamental questions in relation to this research concern the categorization of the examined organization in terms of its size (SME) and knowledge intensity. Regarding the former, the respective corporation entails a total of 42 employees and hence falls into the lower end of the definition (Organization for Economic Co-operation [OECD], 2005) for Small and Medium-sized Enterprises (SME). Catering to the latter, and as already referenced within the theoretical framework, Mats Alvesson (2001) describes knowledge-intensive companies as organizations in which most work can be said to be of intellectual nature, and which is carried out by well-trained, qualified employees. In addition, he lists the development of new products or solutions as a further indication. The examined company operates in the IT business arena and releases new software updates at regular intervals. In line with this finding, the Software Development department represents the largest unit by headcount, entailing both well-trained and experienced employees. As with regards to the executives, three out of the four interview participants possessed university degrees, with the CEO even having achieved a Ph. D. It can hence be safely assumed that the company in question meets the criteria for a knowledge-intensive firm as set forth by Alvesson (2001).

Hansen et al. 's (1999) Three Core Knowledge Management Strategy Questions

The framework from Hansen et al. (1999) focuses on three core questions to determine whether the personalization or the codification strategy would be most suitable for a company.

On the question whether the portfolio would be considered predominantly standardized or customized, the findings initially pointed to the former. During the interviews, the executives said that they were striving for the greatest possible degree of standardization and that the majority of the products had already been standardized by the time this research was conducted. In the future, deep customizations were to be replaced by a single, standardized software engine and configuration management and micro-services. Hansen et al. (1999) give a similar example with DELL computers, where – across a standardized portfolio – it is still possible to make configurational adjustments according to customer requirements.

Likewise speaking for a codification strategy, the interview participants elaborated upon both the company as well as its products having matured after operating ca. 20 years in this particular marketplace. In sharp contrast, however, the Product & Innovation Manager expounded upon the steady development of new functions following the company's aspiration to become unique through continued innovation – a signal strongly advocating towards a personalization strategy (Hansen et al., 1999; Hislop et al., 2018). This strive for innovation may be indirectly confirmed by the headcount of the Software Development department, featuring 15 out of a total of 42 employees and hence representing the dominant department by size.

Initial ambiguity applies not only to the aforementioned subject, but similarly to the question whether tacit or explicit knowledge would be predominantly utilized to solve problems. All four interviewed company executives responded that both types of knowledge would be required depending on the respective context. However, referring back to the company's aspiration for continuous innovation, it is likely that tacit knowledge would in fact prevail. This is supported through Nonaka and Takeuchi (1995), who explicate that the creation of knowledge occurs predominantly through socialization (tacit). Further on, as the company according to the CEO could not rest on prior experience and knowledge, this would impose a direct contradiction to the idea of a codification strategy, which assumes that existing knowledge can be reused to gain scaling effects and efficiencies (Hansen et al., 1999). The questionnaire responses support such contemplations by almost exclusively leaning toward

tacit knowledge. Interestingly, however, the Product and Innovation Manager claimed that already prior to COVID-19, the company had overcome dependencies where the resignation of certain knowledgeable staff members could have jeopardized the survival of the entire company – a fact hinting not only at a strong personalization heritage, but likewise an intended, gradual organizational evolution in the direction of an equilibrium between personalization and codification (Scheepers et al, 2004).

Summing up the above core questions, it may be postulated that the personalization of knowledge has a strong legacy at this company, and that the explicit aim for innovation serves as a further driver in this direction. Nevertheless, the company had deliberately introduced select codification initiatives even before the impact of the COVID-19 pandemic.

Hansen et al. 's (1999) Human Resource Measures vs. Company Status Quo

In addition to the three key questions above, the framework by Hansen et al. (1999) also provides further indicators and recommendations for the optimal management of knowledge. At this point of the discussion, they will primarily be intended to provide a comprehensive picture of the status quo.

While there are no concrete, tangible incentives that seem to exist for knowledge explication, management is primarily orienting towards joint, overarching goals. As the CEO put it, “you cannot deliver [towards goals] without sharing knowledge”. This points at a transformational leadership style, which is common in innovative environments (Zakaria et al., 2004; Nonaka et al., 2006; Yukl, 2013). It seems to be supported by an established culture of appreciation for knowledge sharing amongst all employees, again hinting towards a personalization strategy prevailing.

In terms of training, formal education is primarily aiming at the support of the aforementioned management goals. Following a gap analysis by leadership, external resources are typically involved to address existing shortfalls. This appears correlative for SMEs, with internal resources typically being limited and/ or otherwise occupied (Bley et al., 2016; Giotopolous et al., 2017; Ashrafi & Murtuza, 2008). The actual yet largely unscheduled training within the company is hence taking place via a frequent exchange amongst colleagues and management alike.

As for hiring, and according to the CEO, the company is principally aiming for experts. One such example is the recent employment of an experienced Scrum Master within the Software Development department. Such approach would again be clearly linked to a personalization strategy as set for the by Hansen et al. (1999). It must be noted, however, that this direction is not exclusive as demonstrated by the Sales & Marketing Departments' deviation.

5.2 Discussion on COVID-19-Related ICT and Knowledge Management Adaptions

This sub-section intends to review and discuss the impacts of the COVID-19 induced virtualization on the knowledge management of the examined company.

Covid-19 Impact on Physical (Office) Space Utilization

As elaborated as part of both the introduction and the theoretical framework, a pronounced 'presence culture' existed in Germany prior to COVID-19, with employees only rarely working from home, if at all (Eurostat Labor Force Survey 2018, as cited in Reuschke & Felstead, 2020; Bundesministerium für Wirtschaft und Energie, 2021). The research results support these nation-related, generalized statements insofar as the majority of employees in the examined company spent their working time almost exclusively in the office before the pandemic outbreak. As Figure 3 clearly shows, this explicit office culture had turned into the opposite, with the majority of employees then more or less exclusively working from home. Only a minor part of staff, who was forced to come to office for private (lack of space at home) or business reasons (e.g. systems), continued to commute to the company premises.

This change imposed a fierce caesura to a company encompassing a pronounced personalization legacy and decisive aspiration for market leadership through innovation.

Until the pandemic restrictions had been introduced, knowledge exchange had occurred predominantly from person to person in and across physical spaces like on-site meeting rooms, hallways, coffee areas, as well as employees' desks. Following COVID-19, however, the use of such physical spaces was suddenly and severely constrained, with the entire workforce now having to accustom to an exclusively virtual business environment. Expressed in terms of Nonaka et al.'s (Nonaka & Konno, 1998; Nonaka et al., 2000; Nonaka et al., 2006) spaces (or: bas), the mental spaces including corporate culture, experiences, values, practices and the like had to be adjusted to a new predominantly virtual context.

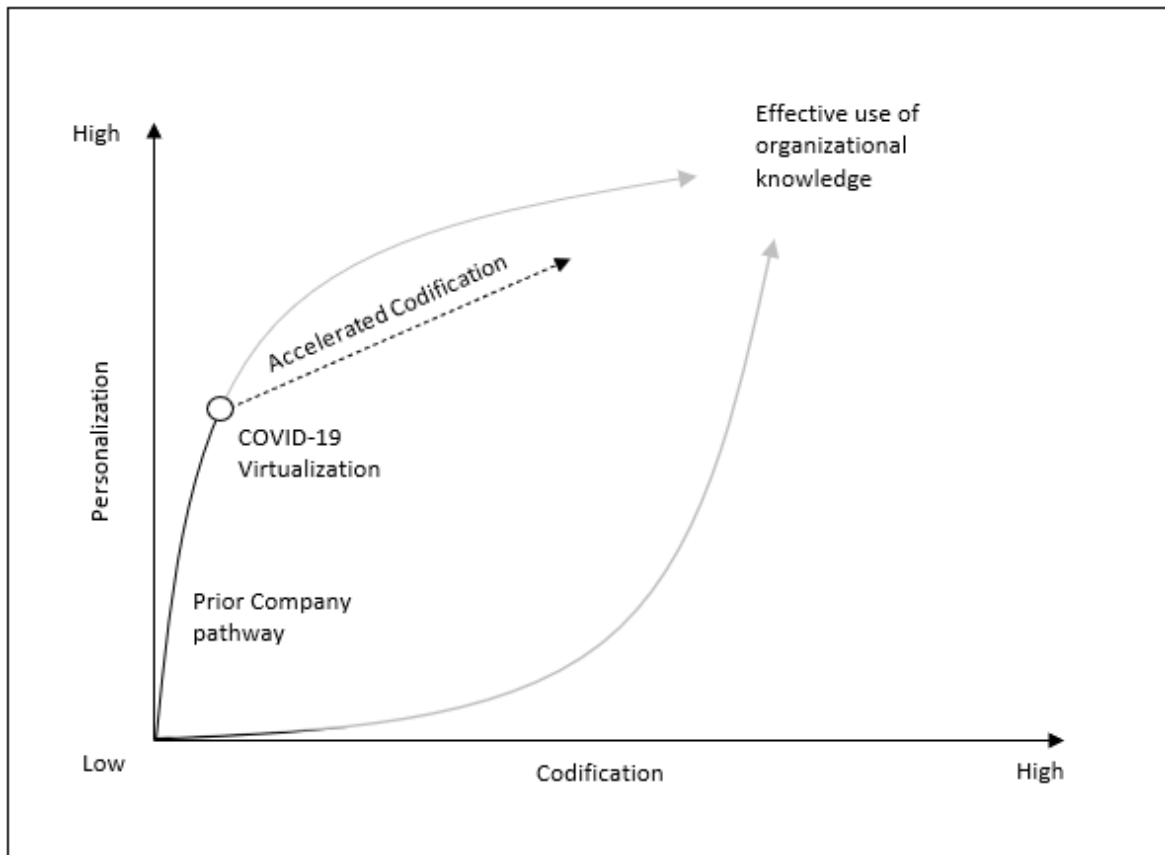
Virtualization and Knowledge Management via ICT

Knowledge creation, according to Nonaka and Konno (1998), primarily takes place during personal interaction between two or more people. As a result of the COVID-19 restrictions, a capable alternative to the inaccessible physical ba had to be identified in order to sustain a core part of business: collaboration. Furthering these considerations, the Product & Innovation Manager stated that a remote setup would not only require alternative means of collaboration, but a tight integration thereof. MS Teams, providing capabilities like phone calls, video conferencing, online chats, calendar and screen sharing functionality, precisely fulfilled this required collaboration scope. Particularly the online video conferencing had been said to be in frequent use, as was also confirmed via the observations conducted as part of this research – a logical move as this ICT channel is characterized by its high degree of richness in light of tacit knowledge transfer (Table 2; Al-Qdah et al., 2018). E-mail, again in line with Al-Qdah et al. (2018), was found to be “too static” (CEO), not allowing instant discussions and making documentation cumbersome. As an unsurprising yet important result, e-mail has become almost obsolete as an ICT for knowledge management.

As with regards to sharing and documentation, the sudden pandemic-induced virtualization forced teams to transfer more knowledge from tacit to explicit formats in an effort to keep it accessible throughout the organization. In other words, the circumstances of COVID-19 unleashed a quantum leap towards a knowledge management equilibrium between personalization and codification, and the effective utilization of the entire organizational knowledge (Scheepers et al., 2004, p. 218). The following figure intends to visualize this disruption in the evolution of the organizational knowledge strategy.

Figure 4

Accelerated Codification as a Result of COVID-19 Circumstances



Note: Own findings combined with Scheepers et al., 2004, p. 218

The intensified codification of the formerly tacit knowledge went hand in hand with a conscious concentration on three core systems – MS Teams for collaboration, Confluence as a company-wide explicit knowledge platform, and Salesforce as another tool for the management of sales-specific explicit knowledge. Thanks to this focus, ICT clutter was reduced, documentation advanced, and previously local knowledge became accessible across the entire company – another significant efficiency gain. On the downside, this focus created notable dependencies related to the three major ICT providers, with little to no options for the SME to influence and/ or control future system progressions. Likewise problematic, both Confluence as well as Salesforce represent web-based applications, with explicit company knowledge now hosted outside of the immediate company premises – a concern in terms of data security and intellectual property.

With regard to employee collaboration, there are further revealing details. Based on the coding of knowledge and use of new ICTs, the associated processes have been improved; a measure also advised by scholars Gevorgyan and Ivanovski (2009). In addition, a new 'interaction etiquette' developed concerning the way employees dealt with one another. Now, employees would first check for availability of their peers or managers via the MS Teams chat function prior to contacting them through phone or videoconferencing in order to avoid disruptions. Both points, the new processes as well as the 'interaction etiquette' fit the mental space model of Nonaka and Konno (1998), which considers the interplay of spaces and context. In this case, the physical context has literally been exchanged by the virtual context due to COVID-19, with the mental spaces and knowledge management culture in this company having adapted accordingly. An unexpected yet remarkable finding linked to the topic of collaboration was the fact that technical staff was found to interacted more in this new virtual environment – a circumstance that the Product & Innovation Manager traced back to the personal preferences of the respective IT specialists. Nevertheless, considering that more than half of the organization's employees are linked to this area, it poses a relevant finding for this very company. On the other hand, many employees still miss the social interaction and personal exchange on site. In addition, there appears to be a reduced level of attention in virtual meetings due to employees undertaking other tasks in parallel and unnoticed. In other words, the virtualization of knowledge management did not lead to positive effects alone.

Another noteworthy perspective concerns the comparison of virtual knowledge management collaboration in MNCs versus the SME in question. The forced virtualization of SMEs represents a unique, pandemic-based event which is de facto without viable academic references. Scholarly articles on virtual knowledge management in MNCs indicate performance deficiencies in comparison to on-site teams (Warkentin et al., 1997). However, the circumstances of the SME differed significantly in a number of key areas. To begin with, the company in question employed a staff of only 42 people, hence providing an almost familial setting in which employees tend to know the organizational knowledge management practices (Davenport & Prusak, 1998) as well as one another well. In support of this factor, and as Figure 2 illustrates, the majority of employees have worked at this company before the COVID-19 restrictions were put into force. In fact, 30 of the 42 employees work more than three years together, 10 even 11 or more years, and only six have joined during the pandemic yet were equally distributed across the organizations' departments. In other words,

mutual employee trust, an essential foundation to effective knowledge sharing (von Krogh et al., 1997; Nonaka et al., 2006), has had sufficient time to develop across the organization. And even cultural differences, as MNCs tend to face subject to their multiple international locations, are nonexistent within this single German and German-speaking entity.

A further aspect that may have contributed to a successful transition from a predominantly physical to a virtual environment may reside in the fact that the SME was catering to the IT environment, employing highly skilled experts for software matters. This industry, according to Reuschke and Felstead (2020), is logically much better suited for home office than organizations in labor-intense, lower skilled marketplaces.

In summary of this sub-section, and certainly unexpected to some extent, knowledge management at this SME has improved considerably over the previous non-COVID-19 status quo.

Virtual Knowledge Management Leadership

The aforementioned success of virtualization would not have been possible without the proactive steering of leadership. As Nonaka et al. (2006) expound, the context in which knowledge is created and managed is set by an organization's leadership. Even if the CEO states that knowledge management has been more democratic since COVID-19, and teams now self-organize from bottom up and aim and structure for collaboration, it was ultimately leadership that set the baseline conditions. In accordance with knowledge management best practices (Zakaria et al., 2004; Nonaka et al., 2006; Yukl, 2013), leadership communicated actively, frequently, and towards a vision, hence inspiring and maintaining trust and followership throughout this challenging transformation. Even incentives such as a joint lunch pizza to honor successful project completions have been adapted to the new virtual situation via food delivery services. Furthermore, the leadership of this company has hired an experienced Scrum Master as a knowledge activist for the core area, software development, who proactively coordinates collaboration and eliminates possible knowledge management impediments (Rigby et al., 2016; von Krogh et al., 1997). And of course the ICT systems, hardware for employees as well as the internal infrastructure (VPN) had been expanded to be on par with major players, negating deficiencies in comparison to MNCs as postulated by Davenport and Prusak (1998), Bley et al. (2016), Giotopolous et al. (2017), or Ashrafi and Murtuza (2008). One measure that was found new and potentially groundbreaking was the change from distinct meetings to open group sessions. This format

reflects previous physical interaction (e.g. hallway meetings), in which not only immediate team members but also other interested employees could take part. A point that was found to be appreciated through an unexpectedly high number of ‘team-external’ participants during the observations, supporting informal and boundary-spanning knowledge exchange.

Minor deviations concerning the knowledge management approach were found in the hierarchically organized and codification-intense Sales & Marketing unit. These differences may be explained by dissimilar, predominantly non-academic education levels, age (Cox, 2016), a gender-based divide in terms of ICT utilization due to this department featuring disproportionately many female employees, a disparate and non-IT orientated operational context (Reuschke & Felstead, 2020), or the personal knowledge management style of the Head of Sales & Marketing. In any case, as Hansen et al. (1999) confirm, such deviations may coexist unless they create serious discrepancies – a factor not found to be applying to the examined case.

5.3 Recommendations for Future Knowledge Management

The following sub-section is closely interlinked with the structure of the division of questions and the consecutive investigation. In the first part, the findings from the framework by Hansen et al. (1999) (questions H1-H6) will be related to these scholars’ strategic knowledge management recommendations. The second part deals with the findings from questions I1-I7 and the respective best practices for virtual knowledge management as set forth in section 2.4.

In terms of the general knowledge management strategy, the personalization approach should – grounding on both the company’s legacy and its strive for innovation – remain to form the basis. Given the unexpected yet remarkable efficiency gains resulting from the pandemic-sparked codification, a hybrid knowledge management strategy including according proceedings could be considered. As Scheepers et al. (2004) have empirically demonstrated, such strategic evolution will benefit the effective utilization of the entire organizational knowledge and capabilities.

Following the above line of argumentation, rewards and incentives should attend to the transfer of knowledge from tacit to explicit formats where possible and appropriate. Especially knowledge hoarders should be identified and addressed with positive, targeted measures like the active development of joint vision, team spirit, performance evaluations,

formulated goals and targets, etc. (von Krogh et al., 1997; Hislop et al., 2018). In light of the data protection concerns related to the essential yet web-hosted ICTs, Intellectual Property (IP) and patent initiatives should be considered to secure codified knowledge (Hislop et al., 2018). Rewards, along those lines, could be established for the generation and explication of unique ideas through a set of formalized stages with the aim of company IP rights or patents.

In terms of training, a hybrid strategy linked to the recommendations of Hansen et al. (1999) would lead to two associated directions. Towards personalization, on one end, training should support the development and improvement of interpersonal skills – a point particularly relevant in a largely technical, anonymous virtual environment (Cascio, 2000). On the other end, and as the Head of Sales & Marketing wisely pointed out, the codification of knowledge requires more than the barebone transfer of tacit knowledge into words, figures, and numbers – it must also be properly comprehended by the recipients. As the ability to interpret code similarly is higher amongst employees with comparable knowledge and backgrounds (Hall, 2006), having previously department-centric knowledge constituents available via Confluence on an enterprise level will now require coders (e.g. IT staff) to attend to diverse recipient (e.g. Sales staff) capabilities. Measures should therefore start by delineating knowledge intended for enterprise-wide application from its local, specialized counterparts. Adding to it, interdepartmental employee exchange should be increased to ensure understanding of de-codification and end-use context, the development of clear code structures and processes, and according employee training (Hall, 2006).

As with regards to hiring and employee reallocation, knowledge activists should be actively looked for and encouraged across this organization in order to drive effective employee collaboration (von Krogh et al., 1997). Both the Scrum Master as well as the Product & Innovation Manager already perform this duty qua their role description. Assuming future company growth, however, these positions could be formally supplemented through the reallocation of existing staff or the hiring of knowledge activists (e.g. Scrum Masters, Product Managers, Coaches, and/ or Consultants).

With the vaccination of the German population advancing at rapid pace at the time this case study is being finalized (tagesschau, 2021), it may be assumed that the pandemic state of emergency including according restrictions may recede or even end soon. For this scenario, the CEO had already noted that he would not opt for a return to the previous, classic 5-day working week on-site as a result of the positive outcomes of the recent virtualization. Instead,

he would consider three days per week for all employees in the office (e.g. Tuesday through Thursday), with the remainder left for his staff to decide where to work. Having learned from this study that the IT-related staff apparently collaborates even better in a virtual environment, while indirectly bolstering codification, this blend may represent a promising direction. Still, personal interaction in a physical environment will aid the development of mutual trust, a key prerequisite to knowledge exchange as mentioned before (von Krogh et al., 1997; Nonaka et al., 2006). The office should thus be re-organized to optimally serve person-to-person interactions, with personal desks potentially to be abolished in order to give way to advanced collaboration spaces. This retreat from personalized desks could also help overcoming detrimental ‘we-vs.-them’ distinctions between the third and the seventh’ floor departments and teams. Company events, trainings, and workshops should be conducted in these new collaboration spaces to foster relationship building on the one hand, but equally to ensure undistracted employee attention on the other. Unquestionably, such physical spaces will also serve the introduction of new employees to, and their respective comprehension and adoption of, the mental spaces and culture of this company (Nonaka & Konno, 1998). And last but not least, existing and future ICTs will only unfold their full potential once training as well as appropriate routines and processes are established and sustained (Gevorgyan & Ivanovski, 2009).

6 Conclusion

The aim of this degree project was to assess the impact of the sudden, historically-unique COVID-19 workplace restrictions on the knowledge management and interrelated ICT utilization of a knowledge-intensive IT SME located in Germany. Based upon the outcomes of this assessment, suggestions for future advancement were to be developed.

A qualitative case study was identified to be the most suitable format in support of this real-life research intending to carve out rich, contemporary and empirical data. In the course of this study, four qualitative, semi-structured interviews were conducted and analyzed with executives fundamentally responsible for the company's knowledge management and knowledge management strategy, namely the CEO, Head of Sales & Marketing, Head of Software Development, and the Product & Innovation Manager. These interviews, which formed the core of this case study, were supplemented by four exploratory meeting observations in the knowledge- and headcount-intensive IT and Sales & Marketing departments comprising 16, 16, 12, and 10 informants respectively. In addition, 14 responses from a company-wide, interrelated questionnaire were evaluated. In order to address the actual thesis aim, the research design was schematically partitioned into three core segments, that is the analysis of the general knowledge management practices and circumstances utilizing the framework of Hansen et al. (1999), intertwined with an investigation of the impact of COVID-19 related workspace restrictions on knowledge management with particular attention on the use of ICTs during the shift from physical to virtual working spaces. The third part entailed possible recommendations for the future improvement of the knowledge management at this company.

Answers to the Research Question

This IT house entertained a pronounced on-site office culture and personalization legacy, both of which suddenly and unexpectedly disrupted by the COVID-19 restrictions. Against this background, it was of great importance for the company to introduce a suitable ICT for collaboration. In Microsoft Teams, a tool was introduced that – alongside its core videoconferencing capabilities – represented a rich channel for Tacit knowledge exchange. Further on, Microsoft Teams united a number of previously separate ICTs such as videoconferencing, phone, chat tools, and document exchange, amongst others, in a single software application. In doing so, a core part of the previous ‘ICT clutter’ could be significantly reduced, and even emails became practically obsolete. To avoid detrimental

disturbances in an environment where the actual busy-state of peers and managers remained inconclusive at times, employees developed a new interaction etiquette entailing collaboration requests issued via ICT chat functions prior to engaging through phone or videoconferencing. An unexpected finding in this context concerned the statements that IT-related staff cooperated even better in the virtual environment than in the physical space, a circumstance said to relate to respective staff preferences. As a second influential response to the pandemic-based virtualization, the company promoted tacit knowledge codification across two core systems. This made formerly local (e.g. personal, departmental) knowledge available to all employees and boosted the effective use of the organizations' overall knowledge in line with Scheepers et al.'s (2004) empirical findings. It also clearly contradicted the initial assumption that knowledge management would be less efficient in virtual spaces than in their physical counterparts (Hansen et al., 1999; Al-Qdah et al., 2018).

Recommendations for further optimization of knowledge management at this company thus referred to training, hiring, and rewards to support this new, hybrid knowledge management strategy as well as the adaptation and support of the corresponding processes and culture. An exciting consideration was based on the future interplay between physical and virtual office spaces. Here, too, a hybrid strategy with a maximum of 2-3 days of physical on-site attendance per week and the remainder in remote settings appeared to make sense. Catering to this proposition, personalized staff desks could be abolished in favor of expanded collaboration spaces.

Limitations and Suggestions for Future Research

Limitations and/ or dependencies of this case study primarily relate to the fact that only one knowledge-intensive company in Germany was examined. Adding to it, this company featured numerous circumstances considered beneficial to a rapid transition to virtual operations, namely a limited number of employees knowing and trusting one another for long, and its IT background and orientation.

These considerations give rise to three questions for future research. Firstly, from an organizational perspective, it would be interesting to understand how companies from other industries were able to master this workspace-related turning point in terms of knowledge management. Secondly, it would be fascinating to identify ideal physical space designs in support of the aforementioned hybrid knowledge management strategy. And thirdly, related

to an upcoming hybrid office environment, it would be enthralling to explore optimal means for leadership to ensure the seamless transition and effectiveness of their knowledge workers.

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