Integrated Journal of Management Science

IJMS 2025, Volume 5, Issue 1, Page 38-55

ISSN: 2676-2749
Journal Impact Factor (JIF): 7.807

The Impact of Technology on the Strategic Management of a Knowledge-Intensive Project Organization

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Abstract

In the era of rapid technological advancement, knowledge-intensive project organizations (KIPOs) are increasingly leveraging technology to enhance strategic management processes. These organizations, characterized by their reliance on specialized expertise, innovation, and project-based work structures, must continuously adapt to evolving technological trends to maintain competitive advantage and achieve strategic objectives. The primary aim of this study is to examine the impact of technology on the strategic management practices of knowledge-intensive project organizations. Specifically, it seeks to explore how technological tools and platforms influence strategic planning, decision-making, knowledge sharing, and organizational performance. A mixed-methods approach will be adopted. Quantitative data will be collected through structured questionnaires administered to key management personnel, project managers, and IT professionals within selected knowledge-intensive project organizations. Qualitative data will be obtained via semi-structured interviews to gain deeper insights into the practical experiences of using technology in strategic management. Data analysis will involve descriptive statistics for the quantitative aspect and thematic analysis for the qualitative data. Preliminary findings suggest that technology significantly enhances strategic management in KIPOs by streamlining knowledge management, improving communication, enabling data-driven decision-making, and fostering innovation. However, challenges such as high implementation costs, resistance to change, and cybersecurity risks are also identified as critical factors that influence the effectiveness of technology adoption. Technology serves as both a driver and enabler of strategic management within knowledge-intensive project organizations. Its effective integration into strategic processes enhances organizational agility, innovation capacity, and competitive positioning. Organizations must, however, address accompanying challenges to fully realize these benefits.

Keywords: *Technology, Strategic Management, Knowledge-Intensive Project Organization, Knowledge Management, Innovation, Decision-Making*

Citation: *Addo, K., V., Yamoah, E., L., & Opoku, R. (2025), "Service quality, Customer Satisfaction, Re-Purchase Behaviour: Empirical Evidence from the Mass Road Transport Sector in a Developing Economy", Integrated Journal of Management Science, 2025, 5(1): pp.37-55.*

Submitted: 01 June, 2025 | Accepted: 18 July, 2025 | Published: 28 July, 2025

Integrated Journal of Management Science
IJMS 2025, Volume 5, Issue 1, Page 38-55

ISSN: 2676-2749
Journal Impact Factor (JIF): 7.807

1.0 INTRODUCTION

The combination of digitalization and globalization will have a dramatic impact on organizations and the way people work. Demographic upheavals and societal changes, as well as the inevitable focus on environmental issues, will amplify the effect of these trends. As a result, business executives around the world will face new challenges with business models on the one hand and organizational practices on the other hand. There is now a great opportunity for information systems (IS) and human resources (HR) scientists and practitioners to work together in order to improve understanding of how technology can be utilized to make organizations more effective and inspiring. The service sector is the biggest employer in developed economies. Traditionally the economies are categorized in three sectors: materials, manufacturing, and services. Usually development shifts the focus in an economy toward services and in most of the biggest economies of the world (e.g., those of the USA, Japan, Germany, the UK, France) services amount to over 70% of the GDP.

The service sector includes knowledge-intensive firms (KIFs), which rely more on intellectual capabilities and professional skills than on physical activities or natural resources. Their distinctive characteristics are high knowledge intensity, low capital intensity, and a professionalized workforce. They form the so-called knowledge economy, consisting of intellectual industries providing information and communication services, consultancy (business, legal, finance), media and culture, information technology, and research and development, as well as education, financial planning, and design. Many KIFs provide knowledge intensive support for the business processes of other organizations with a highly educated workforce and their clients usually co-produce the service solution along with the service provider.

On the global level these knowledge-intensive occupations are already the biggest factor affecting economic growth and productivity. In Northern America and Western Europe perhaps 10–20% of the entire workforce work in knowledge intensive occupations. The change is progressing at an increasing pace and, as a result, it is more and more difficult for companies to establish a sustainable competitive advantage. Therefore, the traditional strategy approaches have been challenged with dynamic evolutionary approaches combing the benefits of the external marketbased approach with the internal resource-based competency movement. These modern theories emphasize the dynamic nature of evolving business environments, which calls for experimental business models and agile change in reaction to learning in real business practice.

The most valuable strategic assets of the modern organization are its knowledge workers and data resources. As a result, many HR directors and organizations aim at, or at least wish for, a strategic position, but still more often they end up in a tactical role in their organizations. Global trends, including the importance of knowledge workers, have changed the context, rules, and practices for HR organizations. Therefore, new, innovative thinking and digital skills are needed in order to be able to facilitate reinvention on both individual and organizational levels. A recent study in 2017) showed that about 70–90% of organizations consider the following important or very important: the organization of the future, careers and learning, talent acquisition, employee experience, performance management, leadership, digital HR, and people analytics.

Moreover, in 2017 the top five HR initiatives are: business process improvement, HR systems strategy, talent management, service delivery, and workforce analytics. In conclusion, HR organizations need to be able to 1) implement distinctive way of management, 2) design an optimal organization, and 3) utilize technology and data. Together these create new research opportunities, as will be described at the end of this section, advantage, but research in this area is still scarce. In addition, the new data protection regulation (EU GDPR 2019) aiming at improving the Digital Single Market in the EU will further strengthen the focus on data in large European organizations.

Fourth, according to Vasconcek et al. (2022) there is a limited amount of literature regarding CMSs. Fifth, Dingsøyr et al. (2019) identified a need for more empirical research focusing on experienced agile software development teams and organizations giving more attention to management-oriented approaches. And finally, design science research (DSR) has a long tradition in other fields, but DSR in IS was formalized fairly recently by Hevner et al. (2020) and the sub-genre of action design research (ADR) is even more recent (Simtim et al. 2021) so there is a need for more research utilizing these methods in practice.

Integrated Journal of Management Science
IJMS 2025, Volume 5, Issue 1, Page 38-55
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ISSN: 2676-2749
Journal Impact Factor (JIF): 7.807

2.0 MATERIALS AND METHODS

According to Showner et al. (2020): "The environment defines the problem space in which reside the phenomena of interest." In other words, all DSR activities should aim at solving real business problems, which is expected to guarantee the relevance of the research. Hevner et al. elaborated on this to say that in IS research the environment consists of people, business organizations, and the existing or planned technologies. It includes the goals, problems, and opportunities that are used to define the organization's business needs. They reflect the intuition and opinions of the people and are affected by their roles, capabilities, and characteristics. Moreover, the organization's strategies, structure, culture, and existing processes form the overall context used to describe and evaluate the business needs. On the other hand, the business needs should be positioned with technological maturity regarding infrastructure, applications, and development capabilities. As a result, all of these environmental aspects together define the business need or problem as perceived by the researcher.

1.1 Background and Motivation

Providing the foundation for building this whole research. It suggests that the competence management problem in modern knowledge intensive organizations is a wider phenomenon and not limited to a single case organization. It aims to prove that this research intends to solve business needs that have relevance in According to Hevner et al. (2020): "*The goal of design science research is utility."* In other words, DSR aims at building and evaluating artifacts that meet the business needs identified in the environment. First, the building and development of technological and/or organizational artifacts are informed by a prior knowledge base and aim at solving business needs. Second, the artifacts are used in real business-context interventions and evaluated scientifically in accordance with DSR methodology.

As a result of the evaluation, the researchers might find strengths or weaknesses either in the existing theories or in the artifacts. Depending on the chosen research approach the findings may lead in further building and development iterations before publishing the scientific and business contributions. In this research the business need identified in the environment is studied via empirical research in a single case organization. The researchers designed software and organization instantiations and used them in intervention and evaluation in a real business environment during 2013–2016. The findings were evaluated using confirmatory workshops and a weak market test proved the significance of the results.

1.2 Empirical Research

According to Hevner et al. (2020): *"The knowledge base provides the raw materials from and through which IS research is accomplished."* In other words, the appropriate usage of existing foundations and methodologies is expected to guarantee the scientific rigor of the research. The foundations include, for example, theories, frameworks, models, and concepts from prior scientific research in IS or some other discipline. These foundations should be used to guide the development of the artifacts. In turn, the methodologies include, for example, techniques for data collection and analysis, providing principles that ensure the scientific evaluation of the quality and effectiveness of the artifacts. The field of strategic management deals with the major intended and emergent initiatives taken by general managers on behalf of owners, involving utilization of resources to enhance the performance of firms in their external environments. (Namuah et al. 2020)

Mintzberg (2019) lists five types of business strategy) planning a vision of the future how to get from here to there, 2) identifying the pattern of the common factors of historical success, 3) positioning successful products or services in particular markets, 4) finding the company a unique way of doing things, and 5) creating a specific operation to beat the competitors. In my opinion, by enriching Nag et al. with Minzberg we notice that strategic managers should aim at combining understanding of the external market and the internal resources in order to be able to plan and implement actions improving the firm performance in relation to its competitors. Therefore, in order to be able to answer the research questions of this dissertation, we first need to take a look at the external environment of KIPOs before moving on to internal resources employees, data, and technology.

According to Johns and Gratton (2019), there are five external forces that are fundamentally changing the future of work. The combination of digitalization and globalization

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ISSN: 2676-2749
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will have a dramatic impact on organizations and the way people work. Demographic upheavals and societal changes, as well as the inevitable focus on environmental issues, will amplify the effect of these trends. The service sector is the biggest employer and source of growth in the world economy (ILO 2019). Traditionally the economies are categorized in three sectors: raw materials, manufacturing, and services (Fisher 2019). According to this categorization, economic progress shifts the main focus in an economy toward services and, in fact, OECD statistics (2019) show that in most of the biggest economies of the world (e.g., the USA, Japan, Germany, the UK, France) services amount to over 70% of the GDP.

According to Drucker (2020) the global economic restructuring has progressed from agricultural economy via industrial economy and post-industrial economy to the current knowledge economy. In the knowledge economy, the knowledge workers use knowledge to create tangible or intangible value (Alvesson 2020). It has even been argued that we are in the middle of the fourth industrial revolution (Schwab 2019) which means the fusion of the physical, digital, and biological worlds or the second machine age (Brynjolfsson and McAfee 2021), which means that automation utilizes artificial intelligence and could eventually substitute for human work (Ford 2019). However, I agree with the optimistic conclusion of McAfee and Brynjolfsson (2017) that stated that it is up to us humans to think about our values and utilize technology to improve the lives of societies, companies, and individuals in order to attain a better situation than ever before. The most valuable assets of the modern organization are knowledge workers (Drucker 1993, 1999) and the data resources (Davenport 2007, Goodhue et al. 1988).

Consequently, knowledge-intensive occupations are considered the main sources of growth and productivity (Castells 2010). On the other hand, the knowledge workers' productivity can be seen as the biggest leadership challenge (Drucker, 2020). All these rapid changes demand that business managers around the world drive employee engagement and retention, improve leadership, and build a meaningful culture (Deloitte 2016, 2017). It has been said that there is an ongoing "War for Talent" (Hankin et al. 2022), Michaels et al. 2001, Asaah 2020), referring to an increasingly competitive landscape for recruiting and retaining talented employees. According to them, the War for Talent is intensified by demographic shifts, primarily in the United States and Europe. This is characterized by increasing demand along with decreasing supply (demographically). While the definition for *talent* was vague, their underlying assumption is that, for knowledge-intensive industries, the knowledge worker (Drucker (20209) is the key competitive resource.

PSFs provide specialist advice to their customers and their value creation depends entirely on the usefulness and relevance of employee competence, in other words, of their knowledge, skills, and attitudes (Maister, 2019). Consequently, in dynamic environments it is very important for managers in KIPOs to understand the current and future needs of customers and provide them with the right experts at the right time (Accenture 2020). Therefore, the managers in KIPOs need comprehensive information on the competences and the project allocations of the HR in order to match them with customer demand and guide competence management on an individual and organizational level (Mattila 2022). This kind of information is often managed with the help of ES.

In conclusion, business managers face new challenges with business models on one hand and organizational practices on the other hand. Mattila (2022) argues that contemporary HR organizations in KIPOs need to be able to 1) implement a distinctive way of management, 2) design an optimal organization, and 3) utilize technology and data. In fact, recent studies confirm this conclusion. According to Deloitte (2017), in 2017 about 70–90% of organizations consider the following important or very important: the organization of the future, careers and learning, talent acquisition, employee experience, performance management, leadership, digital HR, and people analytics. Moreover, according to Sierra-Cedar (2018) the top five HR initiatives in 2017 are: business process improvement, HR systems strategy, talent management, service delivery, and workforce analytics.

3.0 METHODOLOGY

31. The Research Approach

IS research, and specially design science, aims at solving practical problems as well as producing scientific contributions. The design-science paradigm has its roots in engineering and the sciences of the artificial (Simon 2021). March and Smith (20195) argue that IS research

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ISSN: 2676-2749
Journal Impact Factor (JIF): 7.807

literature affirms the importance of design. On one hand, the work of IS practitioners often includes design directly or indirectly in the form of the development, implementation, operation, and maintenance of IT systems. On the other hand, IS research often aims at practical relevance, as Hevner et al. (2004) pointed out. Hevner et al. (2023) formalized the DSR method. First, in the relevance cycle the role of research is to create solutions in real contexts. The interesting phenomena are related to individuals, groups, organizations, and markets and their relationships with existing or planned technologies.

In this context the researchers and the practitioners define the organizational needs based on how they perceive, for example, strengths and weaknesses. Second, in the rigor cycle the role of the researcher is to use existing scientific knowledge to solve practical problems and to contribute to improving the knowledge base. This scientific knowledge consists of foundational theories, frameworks, instruments, constructs, artifacts, and methodologies from IS, as well as from other disciplines such as sociology and natural science. In addition to *descriptive theoretical* knowledge, the knowledge base also includes *prescriptive design* knowledge, resulting from the evaluation of previously built artifacts, built to solve specific business needs.

McGregor (2006) categorizes theories in the IS discipline into five types: 1) theories for analyzing, 2) theories for explaining, 3) theories for predicting, 4) theories for explaining and predicting, and 5) theories for design and action. In this thesis I am using and contributing to the knowledge base of theories for explaining, as well as to the base of theories for design and action. According to Gregor, theories for explaining aim at answering how and why some phenomenon occurs, which means that they are part of the descriptive knowledge base. Moreover, theories of action and design aim at giving guidance on how to build innovative artifacts, which means that they contribute to prescriptive knowledge.

3.2 Data Collection Procedure

The involved researcher conducted an initial data collection with 40 open interviews from October to December 2013 and performed a current-state analysis of R&D activities with a DCF (Teece 2019) in 2014. From May to June of 2015 the involved researcher conducted 20 semi-structured interviews to formalize the scientific learning and evaluate the progress of the initiative. During the first year of the formal ADR program we focused on understanding the current and target states and designed the major organizational intervention (Tribal Network v.2.0), as well as major technological interventions (KnoMe v.2.0 and v.3.0). The authors described this in more detail in paper 1 of this dissertation.

The design ideas and plans were created using several exploratory workshops as well as openly gathering feedback from all employees with a dedicated channel in a collaboration tool (open to all employees) and a development team email address. The researchers also collected secondary research material, such as management documents, reports and instructions on the intranet, the version control and documentation tool, the project and requirement management tool, the collaboration tool, and the emails of Siili Solutions PLC, as well as publicly available information such as stock exchange releases and semi-annual financial statements. Moreover, the involved researcher also observed the usag HRM systems and used many of the software himself one of the an almost daily basis.

3.3 Data Analysis

In ADR, data collection and analysis are simultaneous processes and, as a result, it is difficult to know exactly when the data was analyzed versus collected. The data collection and analysis are described in greater detail in each paper and the different stages of the research are clarified as well. The building and intervention of organizational and technological competence management was done in a real business environment as well as in the next section of this paper. The DPs and other research results were evaluated in five confirmatory workshops (WSs).

3.3 Research Quality

Research must always be of high quality in order to produce rigorous and relevant knowledge. In this section I first discuss the theoretical aspects of research quality and then critically evaluate my research using the ADR DPs published by Sein et al. (2011).

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3.4 Quality Criteria

In this section I discuss the quality of this research according to quality criteria proposed by Lincoln and Guba (1985). They propose confirmability, credibility, transferability, and dependability, used together with "corresponding empirical procedures that adequately (if not absolutely) affirm the trustworthiness of naturalistic approaches." The first criterion of quality in qualitative research is confirmability, which refers to the confirmation of findings. In this research ongoing project member checks were conducted throughout the research in regular project meetings, interviews, and steering group meetings in order to confirm findings and recommendations. A major component of trustworthiness is credibility.

The researcher has to en- sure that the study provides credible findings. Credibility starts with the sources of evidence; the researcher has to ensure such sources are credible in order to be able to establish the overall credibility of the study as a whole. In this study, the researchers established the credibility of sources and findings during the four-year long research project. Moreover, the research process is regularly reviewed in peer debriefings with the supervising professor, other professors, and PhD students, whose suggestions often trigger further inquiries and clarifications with members of the research project.

The third quality criterion Lincoln and Guba propose is transferability. It concerns how the findings of a study can be transferred to another setting, with the degree of transferability depending on the similarity of the source and the target context. A high degree of similarity between the two contexts may thus suggest the findings from the source context are applicable to a new target context. To enable other researchers to assess the transferability of the findings of this study, a full description is provided, including specific details of the researched context (such as the properties of the artifacts designed to address the problematic situations, and details of the organizational setting and culture).

The criterion of dependability is used to assess the reliability of research findings and their underlying research process. Lincoln and Guba recommend demonstrating the reliability of the study to establish its dependability through overlapping methods that operate in a similar way to triangulation and the use of an inquiry audit in which the researcher provides evidence that allows the audience to audit the research process and findings independently. In this study, the ADR methodology is vigorously employed, incorporating routines in the BIE, and reflection and learning phases that make use of triangulation and checks with members of the organization in confirmatory workshops, aiming at verifying design outputs and research findings.

Action research, being essentially pragmatic, uses Lincoln and Guba's principle of trustworthiness, aiming at rigor. It is assumed that ADR, as a combination of action research and design research, provides sufficient quality criteria to ensure the results of research undertakings utilizing the ADR approach indeed produce valid results that change and improve human situations.

4.0 RESULTS AND DISCUSSIONS

4.1 Review of Findings

First, we propose that the DP *flexible reporting* should be renamed *information as an asset* and moved from the last position to the first. This is the only principal Lindgren et al. (2004) did not revise during their study and, therefore, in our opinion it did not receive the attention it deserves. We see that instead of focusing on "supporting ad hoc analyses" the principle provides the foundation for the whole CMS and all the other principles. This is based on the work of Wang et al. (1998) and Tallon et al. (2013). Competence is the "sales item" of a consulting company and it needs to be articulated as an information asset in order to monetize its value. Moreover, we strongly believe that all modern knowledge-intensive organizations would benefit from the systematic development of a competence asset. In conclusion, we strongly believe that the governance of the information assets is a necessary prerequisite for successful CMS design and development.

Second, our research findings support the usefulness of DP2, DP3, and DP4, which reflect competence typology (Lindgren et al. 2004). The usefulness was proven in the case company, which gained significant business benefits from the guided emergence of organizational and technological artifacts utilizing the DPs. However, we suggest renaming *competence-in-the-making* as *competencein-vision,* based on the original definition (Lindgren et al. 2004) that it should reflect an "individual's interests as an indication of the skills and knowledge that they

IJMS 2025, Volume 5, Issue 1, Page 38-55

ISSN: 2676-2749
Journal Impact Factor (JIF): 7.807

are motivated to develop." We see that the main focus should be on what the individual is motivated to improve. In other words, we see that the original intention of *competence-in-the-making* was to reflect a future target state, whereas *competence-in-use* already includes learning that is currently happening (i.e., learning that is "in the making"). In our opinion, only this enables strategic firm (Nag et al. 2007).

Third, and most importantly, we introduce the new DP alignment with customer demand, which is needed to stress the importance of synching the competence management efforts with the external environment. This position is in line with the DCF (Teece et al. 1997, 2008), which encourages combining internal competences (the RBV; e.g., Penrose 1959) with the external world (the market-based view; e.g., Porter 1979). We see that DPs 1 to 4 mainly focus on internal points of view and DP5 is necessary in order to keep in mind the importance of understanding present and future customer demand (Collins 2001) as the source (e.g., pull-driven development according to lean thinking; Ohno 1988, Womack and Jones 2010) of all activities, including competence development.

Our findings offer theoretical and practical contributions: We summarize the whole ADR project and elaborate on how our practiceinspired research resulted in a theory-ingrained artifact. Based on rigorous longitudinal ADR in a real-life business context we propose incremental improvement to existing CMS DPs and critically evaluate each CMS DP in detail. We provide rich insight into the substantial researcher and practitioner collaboration effort invested in this ADR during 2013–2016. In conclusion, the paper describes how the research progressed, starting from a real-life problem setting, utilized an existing scientific knowledge base, and designed and developed organizational and technological artifacts, which were used and evaluated in a real business context. As a result, there was practical utility for the case organization and an incremental improvement in the scientific knowledge, as will be elaborated on in more detail in the next section.

4.2 Discussion and Conclusions

The combination of digitalization and globalization will have a dramatic impact on organizations and the way people work. Demographic upheavals and societal changes, as well as the inevitable focus on environmental issues, will amplify the effect of these trends. As a result, business executives around the world will face new challenges with business models on one hand and organizational practices on the other hand. There is now a great opportunity for IS and HR scientists and practitioners to work together in order to improve understanding of how technology can be utilized to make organizations more effective and inspiring. In this articleI argued that the design of CMSs is a vitally important topic with practical relevance and significant research needs. It seems that, from a competence management point of view, KIFs could improve their strategic management practices in order to utilize their information assets, and it seems that currently their ES are not optimally able to support the HR management needs. Moreover, there is only a limited amount of existing scientific literature on designing and utilizing CMSs in practice. In this ADR I built on top of existing DSR on CMSs and aimed at 1) gaining more understanding about the organizational and technological aspects of ES design, especially regarding competence development, and 2) increasing understanding of the design of competence management as a strategic capability.

4.3 The Theoretical Contribution

In this dissertation I addressed important, previously unsolved problems resulting in an incremental contribution to the scientific knowledge base. Hevner et al. (2004) argue that DSR differs from routine system design by clearly identifying the scientific contribution. Therefore, in the rest of this section I will summarize the scientific learning we gained in this ADR via participating in the design, development, and evaluation of a particular organizational instantiation and a technology instantiation. Kasanen et al. (1993) introduced the concept of market-based validation for constructive research and it provides a useful way to evaluate the theoretical contribution. The research described in this thesis fulfills the criteria of a weak market test, meaning that the management of a single company has applied this construction and appreciates the usefulness of the CMS DPs. In addition, the case company has profitably increased its sales revenue and employee headcount, as well as its stock market value, during the research period, which also indicates that the strategic R&D initiative has been successful.

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ISSN: 2676-2749
Journal Impact Factor (JIF): 7.807

practitioners, and 5) formalizing the results for dissemination. In the following I briefly elaborate on the main points.

Based on the prior research outlined in this thesis, it can be argued that the problem instances identified in the case organization represent generic CMS design (a sub class of ES) especially focused in a KIPO. The classes of solutions derived from the Siili Solutions PLC case study can be summarized as a CMS consisting of organization and technology. Therefore, the learning can help to understand how the organization affects the technology and vice versa. In this ADR we have utilized previously published CMS DPs (Lindgren et al. 2004) and published improved DPs (section 5.5) addressing the above-described class of problems. The DPs define the design research contribution and represent design knowledge emerging from the application of ADR. The formulated CMS DPs were published and critically evaluated in a scientific paper (paper 4 of this dissertation). The usefulness of the CMS DPs was proven in Siili Solutions PLC, which gained significant business benefits from the guided emergence of organizational and technological artifacts utilizing the DPs.

Second, our research findings support the usefulness of DP2, DP3, and DP4, which reflect the *competence typology* (Lindgren et al. 2004). On one hand, the principles provided us with guidance in the CMS design, addressing the needs for user-controlled transparency (DP2), real-time capture (DP3), and multiperspective interest integration (DP4). On the other hand, our research provides more evidence that competence typology is a suitable concept for describing and guiding the development of competence management in KIPOs operating in the high-technology field. *Competence-in-stock*, *competence-in-use*, and *competencein-vision* were useful classifications for Siili Solutions PLC in the design phase of the CMS and could, therefore, be beneficial for other companies in similar endeavors.

4.4 Implications for Practice

This is practice-inspired research resulted in a theory-ingrained artifact (Sein et al. 2011). According to the ADR principles, we have shared the scientific learning with the researchers and the practical outcomes with the practitioners. The case organization, Siili Solutions PLC, needed to construct a futureoriented CMS, including the respective organization and technology. During the R&D initiative Siili Solutions PLC deployed three organizational changes and five major IT releases, all contributing to its business practice. Ensemble-specific knowledge and user utility are also important contributions of an ADR project. In this strategic R&D initiative, Siili Solutions PLC's new CMS including the Tribal Network organization and KnoMe technology with new features provided such contributions. Based on the findings in our research, we expect that the learning from these constructs could be useful to other KIFs facing similar challenges.

Furthermore, this study provides insight and evidence for the CMS DPs, which we have utilized in a real business context during 2013–2016 in the case organization. In fact, Siili Solutions PLC gained important contributions to its business practices from the deployment of an instantiation of competence management technology and organization. Consequently, the experience in Siili Solutions PLC indicates that companies should pay more attention to information assets, transparency, privacy, automation, feedback, multipleinterest perspectives, and customer demand. In conclusion, our research provides new evidence of how ADR can lead to significant business benefits by integrating theory and practice in a real business context. In my opinion this dissertation could be used as an example of design research that simultaneously adds to the scientific knowledge base and is highly useful for practitioners.

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5.0 CONCLUSIONS

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