

Operational Business-IT Alignment in Healthcare

Theoretical Foundation
and Empirical Evidence

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Dedicated to my family

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Andy Weeger

Zusammenfassung (German Summary)

Die Chancen der digitalen Transformation des Gesundheitswesens sind weitreichend: durch die Digitalisierung können die Qualität von medizinischen Dienstleistungen verbessert, die Patientensicherheit erhöht und die Kosten gesenkt werden (Agarwal et al. 2010; Jones et al. 2014). Die bisherige Forschung zeigt jedoch, dass zur Realisierung dieser Potenziale erhebliche Herausforderungen überwunden werden müssen. Unter anderem weisen erste empirische Befunde darauf hin, dass die Implementierung generischer Informationssysteme nicht zielführend ist (Oborn et al. 2011; Poon et al. 2004). Stattdessen zeigt sich, dass sowohl Informationstechnologien (IT) als auch tradierte Prozesse und Strukturen bewusst und kontinuierlich aneinander angepasst werden müssen (Fichman et al. 2011; Goh et al. 2011; Greig et al. 2012; Paul et al. 2012).

Da in der Vergangenheit viele IT-bezogene Veränderungsprozesse im Gesundheitswesen gescheitert sind oder sich zumindest am Rande des Scheiterns befanden (Bhattacharjee and Hikmet 2007; Doolin 2004; Heeks 2006), scheint die Identifikation und Implementierung notwendiger Anpassungen eine große Herausforderung darzustellen. Um in Zukunft solche Szenarien zu vermeiden, sind neue oder angepasste Theorien gefragt, die das Verständnis von IT-bezogenen Veränderungsprozessen im Gesundheitswesen verbessern und Verantwortliche in der Praxis befähigen, diese unter Berücksichtigung der Charakteristika des Gesundheitswesens effektiv zu gestalten (Fichman et al. 2011; Kellermann and Jones 2013).

Diese Dissertation zielt darauf ab, Erkenntnisgewinne in diesem Themenfeld zu erzielen. Die Ergebnisse sollen dazu beitragen, Forschung und Praxis zu befähigen, digitale Transformationsprozesse im Gesundheitswesen besser zu erklären, zu prognostizieren und zu beeinflussen. Um dies zu erreichen, analysieren die Arbeiten dieser kumulativen Dissertation IT-bezogene Veränderungsprozesse in Krankenhäusern und zielen auf die Beantwortung folgender übergreifenden Forschungsfrage ab:

Wie können IT und medizinische Praxis effektiv aneinander angeglichen werden, so dass die erwarteten Potenziale realisiert werden können?

Zur Beantwortung dieser übergreifenden Forschungsfrage baut die Dissertation auf das Konzept des Business-IT Alignment auf und erweitert dieses. Die Forschung in diesem Bereich weist darauf hin, dass die Realisierung der Potentiale der IT (also deren Geschäftswertbeitrag) maßgeblich von der Abstimmung zwischen IT- und Fachabteilungen auf unterschiedlichen Ebenen abhängt (siehe beispielsweise Chan and Reich 2007; Gerow et al. 2014). Wie die oben zitierten empirischen Befunde im Gesundheitswesen zeigen, ist zur Realisierung der Potentiale der IT insbesondere die Harmonisierung von IT und tradierten Strukturen und Prozessen notwendig. Deshalb macht die Dissertation Prozesse, die eine solche Harmonisierung vorantreiben, zum primären Untersuchungsgegenstand. Diese Prozesse werden der operativen Ebene des Business-IT Alignment (OBITA) zugeordnet (Chan and Reich 2007).

Im Detail zielen die Arbeiten dieser kumulativen Dissertation darauf ab, besser zu verstehen, wie soziale und kognitive Aspekte von IT-bezogenen Veränderungsprozessen auf operativer Ebene das Business-IT Alignment beeinflussen. Um hierzu belastbare Erkenntnisgewinne zu erzielen, wird das Phänomen aus verschiedenen Blickwinkeln untersucht und unterschiedliche

Theorien und Methoden trianguliert. In der Einführungsschrift werden zunächst die Besonderheiten des Kontexts und die Rolle der IT im Krankenhaus im Detail beleuchtet, die Erkenntnisse der Forschung zum operativen Business-IT Alignment zusammengefasst und die primären theoretischen Perspektiven und Methoden diskutiert. Basierend auf diesen Erkenntnissen wird die übergreifende Forschungsfrage detailliert und vier untergeordnete Forschungsfragen abgeleitet.

Um diese Forschungsfragen zu beantworten, werden im ersten Teil der Dissertation konkrete Problemfelder der Harmonisierung zwischen IT und medizinischer Praxis identifiziert. Die empirischen Ergebnisse zeigen, dass im Wesentlichen Fehlansetzungen zwischen IT und medizinischer Praxis die Realisierung der Potenziale der Digitalisierung begrenzen. Diese Fehlansetzungen lassen sich wiederum auf Widersprüche zwischen historisch-kulturell gewachsenen Elementen der Tätigkeitssysteme im Krankenhaus und Charakteristika der IT sowie deren Zusammenwirken zurückführen. Die Widersprüche werden im Detail analysiert, klassifiziert und in ein Rahmenwerk überführt, welches deren Identifikation im Rahmen von IT-bezogenen Veränderungsprozessen vereinfacht.

Im zweiten Teil der Dissertation werden unterschiedliche IT-bezogene Veränderungsprozesse in Krankenhäusern analysiert, die darauf abzielen Fehlansetzungen zu beheben. Die Ergebnisse zeigen, dass neben einer domänenübergreifenden Vernetzung zwischen IT Mitarbeitern und medizinischen Fachkräften auf der operativen Ebene ein umfassendes gemeinsames Verständnis der medizinischen Tätigkeitssysteme und der Rolle der IT innerhalb dieser Systeme kritisch ist. Es wird gezeigt, dass ausgeprägtes Sozialkapital zwischen IT und Fachbereichen eine wichtige Voraussetzung dafür ist, IT und tradierte Strukturen und Prozesse in strukturell entkoppelten Organisationen wie Krankenhäusern effektiv anzugleichen. In diesem Zusammenhang zeigen die Ergebnisse, dass profilierte strukturelle, relationale und kognitive Verbindungen zwischen IT und medizinischem Fachpersonal wesentlich zur Entwicklung eines gemeinsamen Verständnisses über notwendige Veränderungen beitragen. Bezüglich des gemeinsamen Verständnisses zeigen die Ergebnisse die Relevanz des komplexen Zusammenspiels zwischen soziokulturellen und technologischen Elementen organisationaler Tätigkeitssysteme sowie IT-bezogener Widersprüche in diesen Systemen. Die Arbeiten beleuchten insbesondere den wechselseitigen Einfluss von IT-Lösungen auf tradierte Modi der Arbeitsteilung sowie – oftmals implizite – soziale Regeln. Die Fallstudien zeigen deutlich, dass ohne ein umfassendes gemeinsames Verständnis über diese komplexen, sozio-technischen Systeme Krankenhäuser kaum in der Lage sind, IT und tradierte Strukturen und Prozesse effektiv zu harmonisieren. Auf Basis dieser Erkenntnisse wird ein theoretisches Rahmenwerk entwickelt und konkrete Handlungsempfehlungen für die Praxis abgeleitet.

Im dritten Teil der Dissertation werden die theoretischen Erkenntnisse reflektiert, zu einer Prozesstheorie zusammengefasst und ergänzt. Mit dem Ziel, die Ausrichtung zwischen IT und tradierten Strukturen und Prozessen zu optimieren, ermöglicht die entwickelte Prozesstheorie die Beschreibung, Analyse und Gestaltung IT-bezogener Veränderungsprozesse im Krankenhaus. Hierzu werden die IT-unterstützten Tätigkeiten einer Organisation in deren übergeordnete Ziele, konkrete individuelle und organisationale Ergebnisse sowie die zugrundeliegenden Tätigkeitssysteme zerlegt. Basierend auf den empirischen und theoretischen Befunden wird argumentiert, dass die vielschichtigen Tätigkeitssysteme und deren Interaktion das Potenzial zur Erreichung der intendierten konkreten Ergebnisse und

übergeordneter Ziele determinieren. Es wird insbesondere gezeigt, dass IT-bezogene Veränderungsprozesse oftmals historisch-kulturell begründete Widersprüche und Spannungen auslösen oder verschärfen. Ohne ein kollektives Bewusstsein für diese Widersprüche und Spannungen können die von den Veränderungsprozessen intendierten Verbesserungen nur schwerlich realisiert werden. Außerdem wird gezeigt, dass die theoriebasierte Analyse des Zusammenspiels zwischen IT und komplementären soziokulturellen Elementen innerhalb dieser Systeme die Identifikation, Beschreibung und damit auch Planung und Überwachung effektiver IT-bezogener Veränderungsprozesse ermöglicht.

Hinsichtlich der primären Fragestellung dieser Dissertation kann abschließend festgehalten werden, dass (1) ausgeprägtes Sozialkapital zwischen IT und medizinischen Fachkräften, (2) hinreichendes gemeinsames Verständnis zu den vielschichtigen organisatorischen Tätigkeitssystemen und (3) zielgerichtete, iterative Veränderungsprozesse, die darauf abzielen Widersprüche und Spannungen zwischen IT und komplementären soziokulturellen Elementen aufzulösen, für die Realisierung der Potenziale der digitalen Transformation im Gesundheitswesen kritisch sind. Mit diesen Erkenntnisgewinnen leistet die Dissertation einen wichtigen Beitrag zur Forschung und Praxis der Wirtschaftsinformatik sowie der Schwesterdisziplinen Management- und Organisationslehre (Fichman et al. 2011; Gerow et al. 2016).

Introductory Paper

Operational Business-IT Alignment in Healthcare

Theoretical Foundation and Empirical Evidence

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Operational Business-IT Alignment in Healthcare

Theoretical Foundation and Empirical Evidence

1 INTRODUCTION

Digital transformation in healthcare offers tremendous opportunities to improve quality, safeguard patient safety and reduce costs (Agarwal et al. 2010; Jones et al. 2014). However, significant challenges need to be overcome to fully realize the potential of information technology (IT) in healthcare (Agarwal et al. 2010; Fichman et al. 2011). Prior research has called for new theory or an extension of existing theories to help researchers and practitioners understand and account for the unique and complex characteristics of the healthcare domain behind these challenges (Fichman et al. 2011; Kellermann and Jones 2013).

One of the most distinct characteristics of the healthcare industry is the level of diversity that characterizes patients, professional disciplines, treatment options, healthcare delivery processes, and interest of various stakeholder groups (Fichman et al. 2011). Increasing regulation, strong traditions, and pronounced hierarchies further contribute to the complexity of medical reality (Fichman et al. 2011; Goh et al. 2011; Greig et al. 2012; Paul et al. 2012). Among others, these characteristics challenge IT providers and professionals to account for numerous social and technical factors (Cresswell and Sheikh 2013; Kilsdonk et al. 2016). As most IT-related change initiatives in healthcare encounter critical obstacles (Heeks 2006) and result in strong disappointment and resistance to change among users (Bhattacharjee and Hikmet 2007; Doolin 2004), these factors seem to be not easily identified and accounted for. To enhance our understanding in this area and to develop measures that allow practitioners to effectively approach the critical characteristics and challenges of the healthcare domain, design, implementation and use of health IS (HIS) was identified as a major area that requires further research (Agarwal et al. 2010).

Existing findings in this area already highlight that IT and processes and structures of healthcare need to be consciously and continuously adapted (Lapointe and Rivard 2005; Oborn et al. 2011; Poon et al. 2004) such that the design and functionalities of HIS and medical reality reach a sufficient degree of coherence (Goh et al. 2011). Among others, leveraging the potential that come with the digital transformation of healthcare requires IT professionals, users and various other stakeholder groups to acknowledge and balance conflicting needs (Fichman et al. 2011). However, little is known about how the people responsible and affected by HIS-related change processes are enabled to identify and balance

these needs and synchronize HIS and medical practice sufficiently to realize the value expected from IT (ibid.).

To help scholars and practitioners explain, forecast and thus influence the outcomes of IT-related change in healthcare efficiently and to increase the ability to exploit the potential of IT in this domain, this dissertation intends to analyze what is and can be done to make HIS workable in practice. Consequently, the studies spanning this dissertation aim to enhance our knowledge about IT-related change in healthcare and to provide answers to the following overarching research question:

How can IT and medical reality be sufficiently aligned to realize expected potentials?

To reach this objective and answer this research question, this thesis avails itself of the opportunity to leverage in-depth knowledge of IS research to both advance theory and impact practice and policy in healthcare (Agarwal et al. 2010). Thus, the papers included in this study draw on and extend prior business-IT alignment research to enhance our understanding of IT-related change in healthcare.

To date, IS scholars have conducted many studies concerned with aligning the requirements of the business and the potentials of information technologies (see e.g., Chan and Reich 2007b; Gerow et al. 2014a). Overall, these studies emphasize the potential of business-IT alignment to increase the impact of IT on organizational performance (Chan et al. 1997; Chan and Reich 2007b; Henderson and Venkatraman 1999; Kearns and Lederer 2000; Yayla and Hu 2011).

Much research in this field focuses on the top-management level of IT and business (Chan and Reich 2007b) and is concerned with how business strategy supports and is supported by the IT strategy (Gerow et al. 2014b). However, reaping the fruit of aligned strategies (e.g., expedite digital transformation in hospital) requires operational structures, processes and systems to be successfully implemented and maintained (Baker et al. 2011) and IT to be used effectively in daily business operations (Schryen 2010). In this regard, Kearns and Sabherwal (2006, p. 139) conclude that IT-related change initiatives “help convert strategic IT plans into tangible products”. These products are usually developed, implemented and maintained during implementation projects (Vermerris et al. 2014), IT change management (Zolper et al. 2013), and day-to-day IT-business interactions (Wagner et al. 2014; Wagner and Weitzel 2012). Alignment of IT and business at this level is referred to as operational business-IT alignment (OBITA) (Chan and Reich 2007b).

This dissertation conceptualizes OBITA as dynamic processes of mutual adaption of IT and complementary socio-organizational resources at the operational level. By analyzing design, implementation and use of HIS, the papers included in this dissertation aim to enhance our understanding of these processes in healthcare. More precisely, the dissertation focuses on how social and cognitive aspects that characterize IT-related change initiatives in hospitals impact OBITA processes and outcomes. To achieve this goal, the phenomenon is examined from different angles and different theories and methodologies are triangulated.

This dissertation includes nine papers plus this introductory paper. In this paper, the healthcare context and the role of IT are introduced in detail, the findings of a structured review of literature in IS concerning operational business-IT alignment are presented, the major theoretical perspectives taken are summarized, and detailed research questions that

help answering the overall research question of this dissertation are derived. Moreover, this paper introduces the methodologies applied, presents the main findings of the nine papers, and discusses their contributions to theory and practice. As illustrated in Figure 1 below, Paper I, Paper II, and Paper III illuminate how HIS is appropriated and used in medical practice. The aim of these papers is to identify the role and nature of misalignments between HIS and medical reality that need to be approached during OBITA processes. Paper IV, Paper V, Paper VI, Paper VII, and Paper VIII analyze different IT-related change processes in hospitals aimed to resolve or at least prevent such misalignments (i.e., OBITA processes). Paper IV and Paper V focus on the significance and mechanisms of cross-domain interconnectedness between IT and medical professionals (i.e., general social linkages) during these OBITA processes. As these papers highlight the role of cognitive linkages between IT professionals and their stakeholders including prospective users, Paper VI and Paper VIII analyze the role and contents of shared understanding in OBITA processes. Building on the general idea outlined in Paper IX, this introductory paper synthesizes the findings of Paper I-VIII, highlights the theoretical contributions, and outlines the foundations for a process theory of HIS-related change aimed at improving the alignment between HIS and medical reality. By providing an internally consistent explanation of how operational business-IT alignment occurs (at the very least in the healthcare sector), this dissertation offers significant contributions to health IS (Fichman et al. 2011) and business-IT alignment research (Gerow et al. 2016).

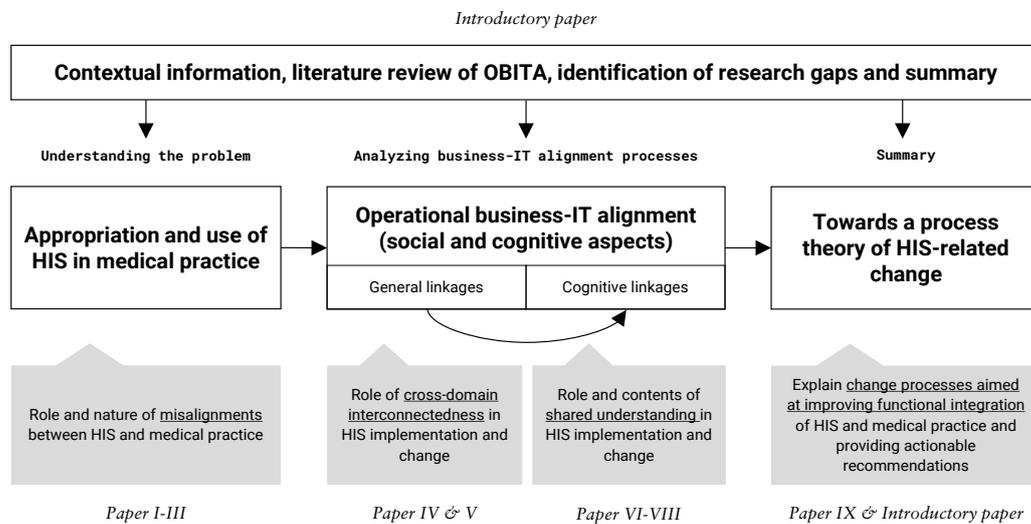


Figure 1: Structure of the thesis

The introductory paper is structured as follows. First the theoretical background is presented. Next, the triangulation strategy and the research methods applied, including structured literature review, quantitative research, and qualitative research, as well as the underlying research paradigms are outlined. Then the main findings of the nine papers included in this dissertation are briefly presented. Finally, the main contributions and implications of this dissertation are summarized and synthesized.

2 THEORETICAL FOUNDATION

2.1 IT in Healthcare

Major trends such demographic change and technological advances have driven health spending for decades. On average across the OECD, health spending grew by 4.1% annually per capita from 2000 to 2009 (OECD 2013). In Germany, spending on health-related services per resident made up more than 11% of the gross domestic product in 2009 (ibid.). However, health spending growth slowed somewhat after 2009 as many countries have taken measures to cut budget deficits and government debt, especially in Europe (ibid.).

In line with these trends, the healthcare system in Germany is increasingly challenged to cope with cost-pressures while ensuring optimal healthcare (Nöthen 2010). In 2014, 34% of all healthcare expenditures in Germany covered costs incurred at hospitals and other stationary and semi-stationary facilities (Statistisches Bundesamt 2017). Not only the share of healthcare spending identifies hospitals as key-players within the German healthcare systems, they also employ more than 1.1 million healthcare professionals, including physicians, healthcare assistants and administrative staff (Statistisches Bundesamt 2015) – more than 20% of all healthcare personnel in Germany.

The German Social Security Code (§107 para. 1 SGB V) defines hospitals as institutions where inpatient treatment and birth assistance is provided, which are under medical supervision, have significant diagnostic and therapeutic capabilities, and follow scientifically recognized methods. Hospitals need to be able to diagnose, cure, and prevent the worsening of diseases and related afflictions as well as to give accommodation to and care for patients. Moreover, the German Hospital Finance Act (KHG) requires hospitals to provide high-quality, patient-oriented and adequate care for the population they serve, while meeting financial restrictions. This definition applies to all hospitals regardless of their type (e.g., teaching hospital, general hospital, community hospital) and their operators (e.g., the government, non-profit-organizations, for-profit-organizations).

Whereas in the past hospitals were predominantly guided by the objective of ensuring high-quality, patient-oriented and adequate care for the population, the focus has widened increasingly to include economic requirements (Piening 2011). Various reform processes concerning the German healthcare system intend to facilitate quality-oriented and efficiency-enhancing competition among hospitals (Bruckenberg et al. 2006; Piening 2011). For instance, the introduction of a performance-based compensation system based on Diagnosis Related Groups (DRGs) in 2003 challenges hospitals to improve on their operational structures and processes and to provide healthcare services more efficiently (Piening 2011). If hospitals are not able to improve their efficiency without sacrificing quality of care, policy even mandates that inefficient hospitals merge with other institutions or close (Klauber et al. 2010).

Thus, German hospitals are under pressure to operate more efficiently and improve their revenue structure (Klauber et al. 2010). As services provided by hospitals are typically the most advanced, the most complex, and the most expensive healthcare services, this is a challenging task (Winter et al. 2010). However, in recent years, hospitals have made great

strides improving their efficiency and profitability. For instance, length of stay has decreased by more than 30% during the last two decades and the number of beds per capita has decreased continuously, although the number of hospital stays continues to grow (Nöthen 2010). However, hospitals remain under pressure to further improve the efficiency of their operations (Piening 2011).

One of the goals of HIS is to enable hospitals to further increase their efficiency and profitability. Digitizing patient care processes is expected to have a tremendous impact on quality, safety, affordability, and accessibility of healthcare services (Agarwal et al. 2010). For example, HIS promises to enable healthcare actors to make the planning and coordination of the treatment more efficient, to increase transparency of clinical processes and to facilitate access to medical knowledge (Blumenthal and Glaser 2007; Goo et al. 2015).

However, there are significant challenges that need to be overcome to realize the potential of HIS (Buntin et al. 2011). For instance, there is compelling evidence that HIS usage is uneven at best (Goo et al. 2015), thus leaving much of the potentials of the digitization untapped (Jones et al. 2014). Considering Germany, hospitals are found to lag significantly behind European averages in terms of adoption and usage of HIS (Sabes-Figuera and Maghiros 2013).

Concerning HIS usage, the literature further reveals that HIS regularly disappoints users and stakeholders in Germany and in other countries (Cresswell and Sheikh 2013). It is found that HIS must, but frequently does not account for numerous social and technical factors that originate in a complex and evolving environment (Cresswell and Sheikh 2013; Kilsdonk et al. 2016). Often, the HIS employed are found to be poorly aligned with the characteristics and needs of intended users and requirements of the healthcare sector (Tan and Or 2015). Consequently, designing and implementing HIS that meet the difficulties of the healthcare sector and its diverse stakeholders still seems to be a great challenge (Kellermann and Jones 2013). Before looking at the role of HIS within healthcare and related issues, important difficulties that characterize the healthcare sector and particularly hospitals are discussed.

2.1.1 Characteristics of Hospitals

Hospitals operate in an industry that is subject to extensive regulation (Fichman et al. 2011). A wide spectrum of governmental regulations and rules of professional conduct (e.g., Basel II, Medical Product Act) aim to safeguard patient safety, treatment quality, and security of supply as well as directing prices for medical services (Piening 2011; Rasche and Braun von Reinersdorff 2016). The financing principles of hospitals in Germany are based on two pillars. Operating costs are disbursed by health insurance companies based on case-related remuneration packages (DRG), while investment costs are primarily covered by state funding (Piening 2011). This limits the scope of strategic activities considerably.

Since the activities of hospitals are concerned with the life and health of patients, their scope for action is further limited by ethical and moral principles. These, for instance, prevent hospitals from pursuing pure profit maximization strategies (Genzel and Siess 1999). However, as discussed briefly in the previous section, the trend is to force hospital management to increase hospital efficiency and profitability (Klauber et al. 2010).

Hospitals are further characterized by structural peculiarities. While other organizations typically have a single hierarchical authority structure, German hospitals are characterized

by three parallel and often disconnected rigidly hierarchical authority structures: the medical directorate, nursing services and administration directorate (Genzel and Siess 1999; Moers 2003). Each of the three hierarchical pillars is represented in the executive committee of the hospital. However, the functional division of labor causes the three professional groups to work largely autonomously (Vera and Kuntz 2007). Among these overarching structure, hospitals are traditionally organized along medical disciplines and sub-disciplines (Piening 2011). Thus, hospitals are often characterized as ‘decoupled organizations’ (Doege and Martini 2008). These structural peculiarities are regarded as a cause of coordination problems and interdisciplinary conflicts in hospitals, especially since cross-functional cooperation between professional groups and relatively autonomous departments is not facilitated by these structures (Badura and Feuerstein 1994). However, the need to increase efficiency and profitability increasingly require actors to overcome the boundaries between specialized disciplines and engage in close cooperation (Rasche and Braun von Reinersdorff 2016).

In addition, the governing body of hospitals is often more complex than those of for-profit companies. In addition to a complex hierarchical structure, hospital management is usually characterized by numerous layers of responsibilities and decision-making rights and a distinctive division of labor. Boundaries between competences are blurred and decision are frequently influenced by political interests (Genzel and Siess 1999). Consequently, decision-making processes are cumbersome and efficient management extremely challenging. The traditional “division of powers” further hampers what Genzel and Siess call “effective problem-solving and decision-making processes” (1999, p. 8).

Healthcare is not only hierarchical, but also professionally driven. Hospitals are referred to as professional bureaucracies (Mintzberg 1979), defined as a “decentralized mechanistic form which accords a high degree of autonomy to individual professionals” and characterized “by individual and functional specialization, with a concentration of power and status in the authorized experts“ (Lam 2005, p. 120). Hospitals physicians enjoy a high degree of professional autonomy, which ensures their sole decision-making authority in the context of their medical activities and privileges like greater control over critical resources and healthcare-related tasks performed by non-professionals (Hall 1968; Walter and Lopez 2008). Furthermore, physicians’ professional ethics requires that they are committed to their professional standards above the standards set by their organization, which sometimes leads to intra-organizational conflicts (McGimpsey et al. 2011). For instance, physicians’ professional ethics require them to focus on patients’ welfare even as the pressure on administration to improve efficiency and profitability grows (Fichman et al. 2011; Klauber et al. 2010). In addition, members of the profession tend resist changes to their traditional forms of behavior (Piening 2011). As a result, some researchers view hospitals as political organizations shaped by the micro-political behavior of the actors involved (McNulty and Ferlie 2002).

Pressure to increase efficiency and profitability has called structures and hierarchies that have developed over time into question (Piening 2011). Reform efforts subject hospitals to changes, which intend to align the management more closely with economic conditions, to strengthen their competitive orientation and increase rationalization pressure, among others (Genzel and Siess 1999). As indicated, today, these efforts are increasingly linked to IT-related changes. Like in other industries challenged by the digital transformation, IT is more

and more commonly implemented as a means end of increasing efficiency and documenting compliance with regulatory requirements (Hübner et al. 2012). The following section discusses the key features of HIS which distinguish it from non-hospital IT.

2.1.2 Health Information Systems (HIS)

For hospitals to increase the efficiency of their activities while ensuring quality of care and patient safety, they need to implement efficient information processing processes that account for complex hierarchies and extensive regulation (Winter et al. 2010). For instance, physicians and nurses need an array of data on the health and treatment status of their patients, which is collected and recorded in different departments or even in external organizations (Lehmann 2005). Furthermore, effective clinical and care decisions require access to current medical knowledge. At the same time, hospital administrators rely on structured documentation on the course of treatment as input for the reimbursement processes. Thus, although they are often structurally decoupled, nearly all professional groups within a hospital thus depend on related and similar information.

Primarily concerned with enhancing information processing in healthcare, HIS play a significant role in dealing with the challenges healthcare is facing. Winter et al. (2010, p. 1) define HIS as “the information processing and information storing subsystem of a healthcare organization” and regard HIS as the memory and nervous system of the hospital. HIS are intended to satisfy the different and complex information requirements of diverse stakeholders during the entire treatment process across all functions and departments (Brailer and Thompson 2004; Lehmann 2005). Within hospitals, different HIS subsystems provide centralized and location-independent access to patient- and treatment-related data and enable healthcare actors to maintain and leverage these data (e.g., for medical decision-making or reimbursement). These subsystems can be classified along three categories: administrative, clinical, and augmented clinical HIS (Sharma et al. 2016). Clinical HIS are systems that are primarily used for patient data collection, diagnosis and treatment. Augmented clinical HIS integrate several clinical HIS and add decision support and reporting capabilities to the data collected by clinical systems. Administrative HIS are primarily concerned with administrative information processing and include, amongst others, accounting and financial subsystems.

Recent research has yielded mixed evidence about the impact of HIS on the quality of healthcare delivery (Chaudhry et al. 2006). There is some evidence that negative outcomes may be attributed to low or improper usage (Goo et al. 2015). However, there is a multitude of research showing that if HIS is sufficiently integrated into medical, patient care and administrative practices, it can have positive effects on healthcare outcomes. For instance, there is evidence that HIS positively influences healthcare quality and patient safety (see e.g., Amarasingham et al. 2009; Chaudhry et al. 2006). Moreover, a longitudinal study using archival data on HIS usage demonstrates demonstrate a positive association between usage of clinical HIS and process quality (e.g., conformance with best practices) and an positive association between the usage of administrative HIS and lower hospital operating expenses (Bardhan and Thouin 2013).

The mixed evidence of the impact of HIS on the process and outcomes of healthcare delivery may be attributed to the complexity of information processing in hospitals. Though differing stakeholders depend on related or similar information, the processes supported by HIS are quite different. The requirements on a ward differ significantly from the requirements in an

operating room or the information processing needs of the hospital administration (Winter et al. 2010). HIS is expected to integrate the partly overlapping information needs of different professional groups and specialized disciplines of a hospital, which is, given the organizational characteristics of hospitals, a highly complex task. Furthermore, HIS needs not only to cover information processing within a single organization, but also information processing across different institutions (e.g., across hospitals and resident physicians).

Prior research emphasized two important dimensions that indicate the quality of HIS: quality of processes and quality of outcome (Winter et al. 2010). The quality of processes of HIS is indicated by characteristics like single recording, multiple usability of data, no transcription of data, no media cracks, efficiency of information logistic, and patient information processing. The quality of outcomes is reflected by the contribution to the hospital's goals, the fulfillment of the expectations of different stakeholders and support for compliance with regulatory requirements. As they can be contradictory, meeting these criteria is remarkably difficult. For instance, goals of a teaching hospital like the support of clinical research and medical education and being very cost-effective are not easily to balance.

2.1.3 Challenges of Integrating HIS in Healthcare Activities

During the last decade, numerous studies have examined the interaction of healthcare professionals with HIS (for reviews of the literature see e.g., Boonstra and Broekhuis (2010); Boonstra et al. (2014); Holden and Karsh (2010); Shaikh and Karjaluo (2015)). To investigate HIS usage, several IS adoption models such as the technology acceptance model (TAM), the unified theory of acceptance and use of technology (UTAUT) as well as the socio-cognitive theory have been utilized and adapted to the healthcare context. Although these studies succeeded in explaining a significant percentage of variance in HIS use, another significant percentage of variance remains unaccounted for. Moreover, effective integration of HIS in healthcare activities is thought to be particularly dependent on factors not covered by these models, particularly factors concerned with the interplay of HIS and contextual peculiarities, such as organizational characteristics of healthcare delivery and clinical processes (Abouzahra et al. 2015). Given their focus on the individual-level, most studies on HIS usage largely ignore the complexity of information processing in healthcare activities, evolving work environments and the influence of IS on these. Overall, prior research identifies a lack of holistic approaches that consider how HIS matches the social and professional complexities of healthcare work (Lluch 2011).

In general, it has been shown that realizing the full potential of HIS is contingent on balancing different requirements (Fichman et al. 2011; Jobst 2010; Winter et al. 2010), including balancing stability (i.e., homogeneity and orderly routines) and sensitivity to variation, ensuring the security of highly personal healthcare information, increasing the efficiency of working processes, increasing documentation quality and reducing documentation effort. As outlined by Fichman et al. (2011), the healthcare delivery setting is characterized by a distinct tension between the need for stability and the need to be able to adapt to local conditions. Orderly routines intend to provide reliability, while sensitivity to variation accounts for the heterogeneity of healthcare professionals, disciplines, procedures and patients that intersect during healthcare activities.

Since stability and reliability are pivotal in healthcare settings, HIS initiatives should carefully manage change to healthcare delivery (Fichman et al. 2011). Particularly, changes to factors

that are providing reliability such as historically evolved and familiarized social structures as well as standardized practices should be carefully considered. In this regard, evidence is given that embedding generic “one size fits it all” HIS is unlikely to succeed (Oborn et al. 2011; Poon et al. 2004). Rather, HIS and existing workflows and structures need to be consciously adapted in tandem (Lapointe and Rivard 2005). Subsequently, HIS implementation requires medical stakeholders and IT professionals to consciously interrelate the design and functionalities of the HIS, medical work practices and, possibly, their underlying power relations sufficiently to reach a sufficient degree of coherence (Goh et al. 2011). This has to be seen as an evolutionary process “that is not only dynamic – occurring over time – but which also needs to be sustained continuously throughout the life [cycle] of an HIS project” (Heeks 2006, p. 133). Moreover, to enable this process, it has been proposed that practices related to HIS design, adaptation, and implementation must not only focus on system considerations, but also reflect the impact of HIS on the different users’ work behaviors and divergent rationalities of stakeholder groups (Bhattacharjee and Hikmet 2007; Heeks 2006). However, evidence is given that specifically hospitals experience difficulties integrating technical, managerial and medical points of views (DesRoches et al. 2008; Goh et al. 2011; Simon et al. 2007).

2.1.4 Summary

Healthcare delivery in hospitals is complex and fragmented in nature (Greig et al. 2012). Activities require significant coordination, interdependence and interactions among an array of professional groups, disciplines, and instruments (Goh et al. 2011; Kannampallil et al. 2011). The actions and interactions among these are governed by historically established social structures, which are continually (re-)produced by relations of power, knowledge and identity (Fichman et al. 2011; Halford et al. 2010). While some of these relations are apparent, others manifest only under certain conditions (Kannampallil et al. 2011). The need to improve efficiency and productivity challenge these traditional relations and demand intense collaboration between currently rather ‘decoupled’ actors. Within these complexities, multiple tensions between diverse goals, preferences, values, incentives, and motivations arise (Symon et al. 1996).

Many stakeholders in the hospital setting have high expectations that advances in technology should ensure or even increase the quality and efficiency of healthcare delivery (Chaudhry et al. 2006; Goldzweig et al. 2009), such as by improving coordination and collaboration among different actors (Erstad 2003; Greig et al. 2012; Hillestad et al. 2005). For example, using an HIS like electronic medical records (EMRs) is expected to satisfy comprehensive information requirements arising in the activities of different professional groups and disciplines with distinct needs (Heeks 2006; Lehmann 2005). Despite the envisioned benefits of HIS for hospitals, implementing these systems bears the risk that they disrupt practices that developed over time and, hence, put efficiency and quality of care at risk. Moreover, there is evidence that HIS tends to show a fragile compatibility with the highly structured and pragmatic nature of healthcare activities (Doolin 2004; Niazkhani et al. 2009).

As a consequence, embedding generic HIS is difficult and unwise (Oborn et al. 2011). Rather, actors need to make significant efforts to understand the role of the HIS within the collective activities and implement reciprocal changes to the technological and organizational systems (Halford et al. 2010; Harrison et al. 2007). Ultimately, managing the alignment of

organizational structures and processes and HIS designs so that both meet the idiosyncrasies of their users and intra-organizational conflicts are mitigated (Goh et al. 2011; Lapointe and Rivard 2005; Poon et al. 2004) seems to be key to realizing the potentials of HIS.

As care given in hospitals is typically the most complex and the most expensive (Winter et al. 2010), aligning the capabilities offered by HIS with the operational infrastructures and processes that characterize healthcare delivery in hospitals is critical for improving the efficiency of healthcare systems (Gauld et al. 2014). Unsurprisingly, the most significant challenges IT in hospitals faces relate to efficient integration of HIS with organizational structures and processes, particularly concerning clinical documentation processes (Hübner et al. 2012; Karbach and Reiher 2017). To better understand how this integration can succeed and to derive actionable recommendations, this thesis avails itself of the opportunity to leverage in-depth knowledge of IS research (Agarwal et al. 2010). More precisely, this thesis draws on and extends the concept of business-IT alignment, which is one of the most prominent concepts in IS research (Chan and Reich 2007b). Given the unique challenges in healthcare, the focus of this thesis is on the operational level of business-IT alignment. The following section summarizes current research in this field.

2.2 Operational Business-IT Alignment

The core idea of business-IT alignment is that plans, objectives, infrastructures and processes of IT and business need to be aligned to create value (Chan et al. 1997; Sabherwal and Chan 2001). There has been and continues to be extensive research into aligning business and IT (e.g. (Chan and Reich 2007b; Kappelman et al. 2013). This research emphasizes the potential of business-IT alignment to impact organizational outcomes and demonstrates that organizations with elevated levels of business-IT alignment outperform those with low levels (Chan et al. 1997; Chan and Reich 2007b; Henderson and Venkatraman 1999; Kearns and Lederer 2000; Yayla and Hu 2011). It has also been shown that business-IT alignment positively impacts utilization of IT and profitability and thus generate sustainable competitive advantage (Gerow et al. 2014b; Kearns and Lederer 2003). In contrast, failing to improve business-IT alignment could lead to poor resource allocation and failed IT initiatives, which adversely affects firm performance (Chen et al. 2010; Ravishankar et al. 2011). Although the concept is rather simple and the outcomes worthwhile, research has still not fully outlined how the efforts of business and IT can be synchronized (Grant 2010). This knowledge gap is a likely barrier to achieving sustained business-IT alignment (Vermerris et al. 2014).

Reviewing prior research on business-IT alignment, Chan and Reich (2007b) and Gerow et al. (2014b) conclude that research has failed to provide a consistent definition of business-IT alignment. Building on the strategic alignment model (Henderson and Venkatraman 1999), however, most studies assume that business-IT alignment occurs at strategic and operational levels across business and IT (Chan and Reich 2007b; Gerow et al. 2016; Gerow et al. 2014b; Venkatraman 1989).

Business-IT alignment at the strategic level commonly refers to the integration of business and IT strategies, objectives, and plans and primarily concerns the upper-echelons of organizations (Reich and Benbasat 2000). This type of business-IT alignment is also commonly termed as intellectual alignment (Gerow et al. 2016). At the operational level,

business-IT alignment is concerned with the integration of the infrastructures and processes of both domains (Gerow et al. 2014b). Consequently, OBITA is usually defined as “the link between organizational infrastructure and processes and I/S infrastructure and processes” (Henderson and Venkatraman 1999, p. 476). OBITA is also referred to as structural alignment or functional integration at the level of infrastructures and processes (Chan and Reich 2007b). Alignment across the two domains of business and IT such that strategies are linked with infrastructure and processes is usually conceptualized as cross-domain alignment (Gerow et al. 2014b).

Though alignment is not restricted to the strategic level, past research predominantly focused on the top-management level of IT and business (Chan and Reich 2007b). Reaping the fruit of aligned strategies, however, most likely requires that strategic relevant structures, processes and systems are successfully implemented and maintained (Baker et al. 2011). This usually takes place in dedicated implementation and change projects as well as during day-to-day operational processes between business and IT professionals (Jenkin and Chan 2010; Vermerris et al. 2014; Zolper et al. 2014). Thus, it is not counterintuitive that alignment at the operational level has been found to be related to organizational performance (Gerow et al. 2016; Wagner et al. 2014; Zolper et al. 2014). However, knowledge concerning the mechanisms of operational business-IT alignment is rather limited (Chan and Reich 2007b; Zolper et al. 2013).

The following sections present the findings of a structured literature review following the methodology as proposed by Webster and Watson (2002) in an effort to summarize the state of knowledge about OBITA (n = 19 articles). The annotated bibliography in the appendix summarizes the research aims and main contributions of these articles. Additional details on the methodology are provided in the methodology section (see Section 3.1).

2.2.1 Definitions and Perspectives on OBITA

Most of the definitions used in the articles relate to the strategic alignment model (SAM) as proposed by Henderson and Venkatraman (1999) and refer to OBITA as either the process of the integration of operational aspects of business and IT (i.e., process-view) or its outcome (i.e., outcome-view). Table 1 summarizes the definitions of OBITA.

Table 1: *Synthesis of definitions of OBITA*

Overarching definitions	Used/discussed by
Outcome-view	
<i>Technological focus</i>	
Integration of or link between organizational (infra-)structure and processes and IT (infra-)structure and processes (also labelled as internal integration, structural alignment, and functional fit)	Boonstra et al. (2011), Chan (2002), Gerow et al. (2014a), Gerow et al. (2014b), Gerow et al. (2016), Lee et al. (2008), Martin et al. (2008), Tarafdar and Qrunfleh (2009)
The “extent to which IT capabilities support the development and deployment of the firm’s assets” (labelled as operational integration)	Rivard et al. (2006, p. 35)

Overarching definitions	Used/discussed by
<i>Social focus</i>	
Linkages between business and IS staff at the operational level (also labelled as cross-functional interconnectedness)	Bharadwaj et al. (2007), Wagner et al. (2014), Schlosser et al. (2015), Wagner and Weitzel (2012)
Process-view	
<i>Technological focus</i>	
Continuous and collaborative process of adapting and reconfiguring organizational (infra-)structure and processes and IT (infra-)structure and processes	Benbya and McKelvey (2006), Dreiling et al. (2006), Vermerris et al. (2014), Zolper et al. (2014)
Process of aligning information technology capabilities with the needs of the business	Burton-Jones et al. (2013), Vessey and Ward (2013)

Concerning the outcome-related perspectives of OBITA, most definitions focus on technological aspects of the business-IT relationship and conceptualize OBITA as the extent to which organizational structures and processes and IT infrastructure and processes are functionally integrated. However, there is also a significant research stream that focuses on social characteristics of the business-IT relationship that precede technical outcomes. From this perspective, OBITA is conceptualized as social and cognitive linkages between business and IS staff at the operational level (e.g., Wagner et al. 2014).

Those rather static technical or social outcomes of alignment are contingent on on-going alignment processes between business and IT at the operational level (Tarafdar and Qrunfleh 2009). These processes involve maintenance and enhancement of IT and business infrastructure and processes, such as IT implementation, IT maintenance and business process redesign activities (Vessey and Ward 2013; Zolper et al. 2014). The papers that adopt a process-view conceptualize OBITA as a dynamic process of adapting business and IT infrastructure, processes and related capabilities to changing environments (e.g., Benbya and McKelvey 2006; Vermerris et al. 2014). These papers analyze how business and IT units can be integrated technologically or socially and focus on either the day-to-day business between business and IT professionals (e.g., Zolper et al. 2014) or cross-functional projects (e.g., Dreiling et al. 2006; Vessey and Ward 2013).

In addition to differences concerning the conceptualization of alignment either as an outcome or a process, cross-paper analysis also revealed different and sometimes inconsistent insights on alignment. These differences stem primarily from the different theoretical perspectives used to explain OBITA. The primary insights offered by different theories are summarized in Table 2. Additionally, the most remarkable differences are briefly discussed below.

First, the theories either focus on the relationship between technological (e.g., Dreiling et al. 2006; Vessey and Ward 2013) or social components (e.g., Wagner et al. 2014; Zolper et al. 2014) of the business-IT relationship. Although some papers acknowledge that OBITA is a multidimensional phenomenon that includes social and technical aspects, there are few papers that explicitly attempt to analyze both social and technical characteristics (Lee et al.

2008). Rather prior research either focuses on the relations between IT and business professionals or at technical aspects such as infrastructures, processes and systems.

Second, if seen as a process, OBITA refers to either continuous or discontinuous adaptations of business and IT infrastructure and processes. Conceptions of OBITA that build upon theories like complexity and coordination theory hypothesize that processes leading to functional and social integration of business and IT are continuous (Benbya and McKelvey 2006; Burton-Jones et al. 2013). These theories draw on the idea of co-evolutionary systems. Co-evolution of business and IT refers to the dynamic and interactive process of mutual adaptation and change between the components of business and IT at multiple levels (Vessey and Ward 2013). Adaption and change are the result of “a recurrent, cumulative, and probabilistic progression of variation, selection, and retention of organizational entities” (Van de Ven and Poole 1995, p. 518). Consequently, adaptation and change takes place continuously and does not require special triggers. In contrast, punctuated equilibrium theory assumes that adaptation processes only occur after critical events. Moreover, punctuated equilibrium theory assumes that these rather short patterns of radical change are followed by relative long patterns of stability (Burton-Jones et al. 2013). Thus, applying this theory leads to a discontinuous conception of OBITA (Benbya and McKelvey 2006).

Third, OBITA is either seen as the result of intentional behavior driven by actors' rationality (e.g., Bharadwaj et al. 2007; Schlosser et al. 2015; Vermerris et al. 2014; Zolper et al. 2014) or as the result of a generative processes that is at least partially driven by random variation (Benbya and McKelvey 2006). Though variation is determined by the range of available capabilities such as available knowledge and IS configuration patterns (i.e., genetic variance) and bounded by a relative stable set of core beliefs and basic rules (Benbya and McKelvey 2006), adaptation and change results from the desire to find the best fit with the environment (Vessey and Ward 2013). In contrast to the idea of OBITA as being contingent on intentional behavior, complexity theory assumes that adaption and change is self-organized and not determined by managerial rationality. However, there are attempts to develop non-deterministic theories that recognize both (bottom-up) generative processes and planned (top-down) management interventions. For instance, Vessey and Ward (2013, p. 289) state that “certain top-down initiatives are essential to facilitate the notion of adaptive IS in an organizational context.”

Table 2: *Insights from different theoretical perspectives on OBITA*

Perspective	Insights	Employed by
<i>Technological focus</i>		
Resource-based view	OBITA requires the IT capabilities and IT resources of a firm to support the efficient development and exploitation of its primary assets.	Rivard et al. (2006), Gerow et al. (2016), Bharadwaj et al. (2007), Lee et al. (2008)
Complexity theory	Business and IT reflect at least two complex adaptive systems (CAS). OBITA is a generative process of self-organization of CAS where organizational actors adapt the systems to fit with their tasks and local contingencies.	Benbya and McKelvey (2006), Burton-Jones et al. (2013)
Punctuated equilibrium theory	OBITA is triggered by crises, which force organizations to make transformative decisions concerning business and IT. Changes to business and IT are implemented during a relatively brief period of rapid change.	Burton-Jones et al. (2013)
Institutional theory	Organizational actors adapt business and IT infrastructures and processes to gain legitimacy by conforming to institutionalized structures.	Burton-Jones et al. (2013)
<i>Social focus</i>		
Boundary spanning theory	Business and IT reflect at least two distinct communities of practice. OBITA requires bridging boundaries between these communities of practice (i.e., business and IT units).	Zolper et al. (2014)
Coordination theory	OBITA requires efficient management of interdependencies between business and IT among organizational activities.	Bharadwaj et al. (2007)
Social capital theory	OBITA requires business and IT units to be structurally, relationally, and cognitively interconnected.	Wagner et al. (2014), Zolper et al. (2014), Schlosser et al. (2015)

2.2.2 Dimensions of OBITA

Following the analysis of the differences of definitions and theoretical perspectives discussed above, prior research indicates that OBITA has both a functional and a social dimension. OBITA is manifested in the extent to which functional components of the business-IT relationship of an organization are integrated and harmonized to create value for the organization. Moreover, prior research indicates that to attain and maintain functional integration, business and IT professionals must form effective collaborative partnerships,

including joint activities aimed at adapting and maintaining business and IT infrastructure and processes.

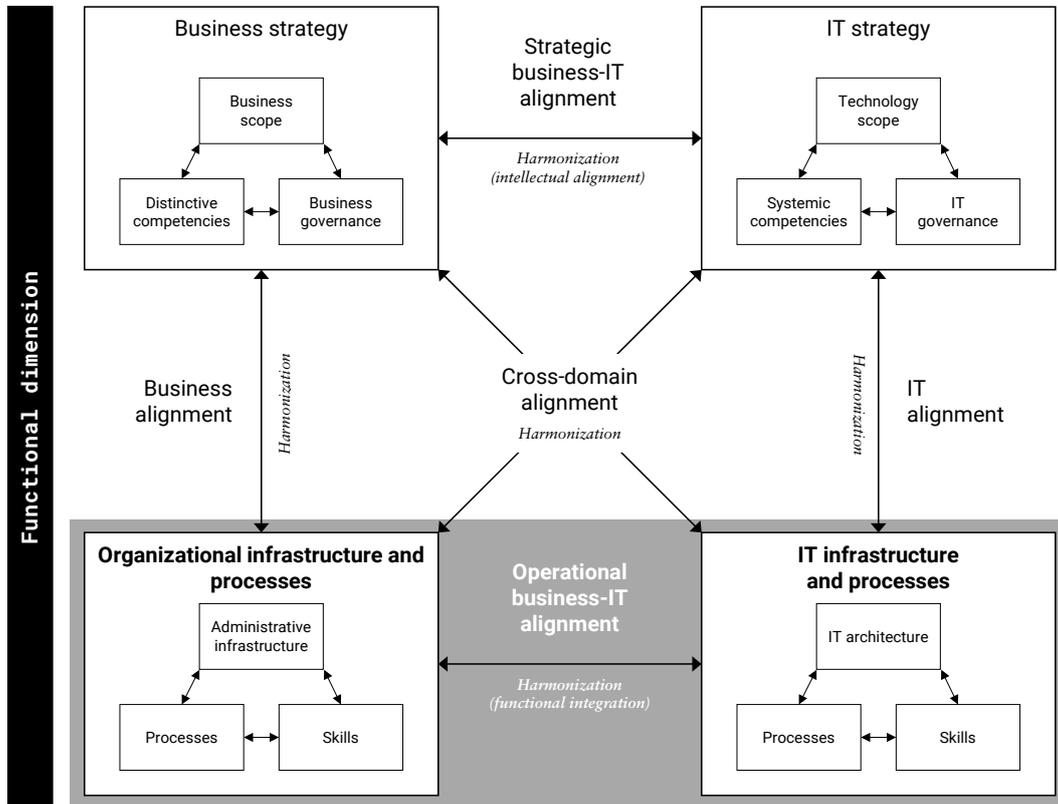


Figure 2: The functional dimension of OBITA based on the SAM (Henderson and Venkatraman 1999)

Figure 2 depicts the functional dimension of OBITA based on the SAM as proposed by Henderson and Venkatraman (1999). The functional dimension is concerned with the harmonization and integration of a firm’s organizational infrastructure and processes and its IT infrastructure and processes. According to Henderson and Venkatraman (1999), organizational infrastructure and processes involve components like the organizational structure, work- and information flows as well as operational capabilities that are necessary to implement strategic objectives. Components of the IT infrastructure include the definitions, governing policies, and implied priorities for hard- and software technologies and data, work processes that are critical to the efficient operation of the IT infrastructure as well as capabilities of the IT workforce (Henderson and Venkatraman 1999). Table 3 summarizes the functional components that are related to OBITA and discussed by prior research.

Table 3: Functional components of OBITA

Concept	Used/discussed by
Business domain	
<i>Organizational/business structure</i> refers to assets that impact profitability	Benbya and McKelvey (2006), Boonstra et al. (2011)
<i>Business processes</i> (best-practice/standardization vs. customization)	Bharadwaj et al. (2007), Gerow et al. (2014b), Tarafdar and Qrunfleh (2009), Zolper et al. (2014)
IT domain	
<i>IS infrastructure</i> involves platform technologies, network and telecommunications technologies, databases, and a variety of shared services	Benbya and McKelvey (2006)
<i>IS structure</i> refers to specialized IS and facilities that support routine business activities, problem solving, and process-monitoring	Boonstra et al. (2011)
<i>Enterprise architecture</i> refers involving business processes and associated hardware, software, data, and platforms	Vessey and Ward (2013)
<i>Information systems</i> including enterprise systems and their capabilities to integrate data and business processes	Bharadwaj et al. (2007), Benbya and McKelvey (2006), Dreiling et al. (2006), Rivard et al. (2006), Vessey and Ward (2013), Zolper et al. (2014)
<i>Procedures and activities</i> including decision-making processes, customer service and IT development	Gerow et al. (2014b), Tarafdar and Qrunfleh (2009)

Tensions between these functional components of the business-IT relationship are expected to trigger OBITA processes and to facilitate organizational innovativeness (Benbya and McKelvey 2006). These OBITA processes, in turn, strive to resolve or mitigate the tensions between the functional components of the IT-business relationship. Prior literature shows that the components are adjusted and integrated during alignment processes such as implementation projects (Vermerris et al. 2014), change-requests (Zolper et al. 2013), and day-to-day IT-business interactions (Wagner et al. 2014).

The literature demonstrates, for instance, that tight integration of a firm's IS and business processes increases visibility of information and improves information flow (Bharadwaj et al. 2007). Prior research, however, also shows that effective integration functional components requires organizational actors to balance competing requirements such as reducing complexity of the IT infrastructure (e.g., by means of technology standardization and/or the utilization of configuration patterns) or business processes (e.g., by means of using best-practice processes) and organization- and process-specific customizations (Dreiling et al. 2006; Tarafdar and Qrunfleh 2009).

Functional integration between business and IT in terms of processes and outcomes requires a sufficient degree of coordination and commitment to mutual goals between business and

IT units (Bharadwaj et al. 2007; Wagner et al. 2014). Without such cross-functional interconnectedness, activities that were found to be critical to increase functional integration such as project prioritization and monitoring, management support and functional sponsorship of projects, and dynamic resource allocation are hardly effective (Schlosser et al. 2015; Tarafdar and Qrunfleh 2009).

These findings underline the importance of the social aspects of OBITA. The social dimension of business-IT alignment relates to the characteristics of the relationships between business and IT staff and builds the foundation for effective functional integration (Schlosser et al. 2015; Wagner et al. 2014). These relationships are reflected by the business-IT social structures and their contents that “occur at the interface between business and IT or within these units” (Zolper et al. 2014, p. 149). Thus, the social dimension of OBITA refers to the structure and quality of linkages between businesses and IS staff at the operational level (Bharadwaj et al. 2007; Schlosser et al. 2015; Wagner et al. 2014; Wagner and Weitzel 2012). Strong linkages between business and IT professionals have been found to positively impact their ability to solve operational problems and to fulfil change requests (Wagner et al. 2014; Wagner and Weitzel 2006; Zolper et al. 2014). Figure 3 depicts the social dimension of OBITA within the SAM.

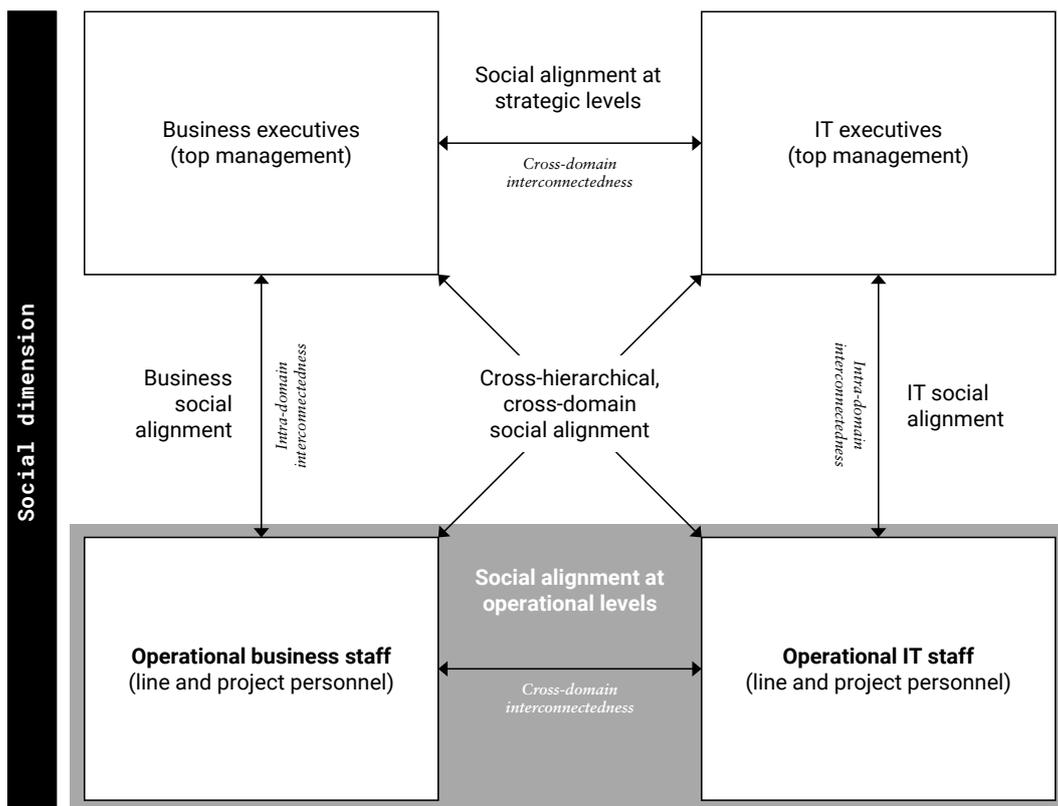


Figure 3: The social dimension of OBITA based on the SAM (Henderson and Venkatraman 1999)

Prior research examines different components of social OBITA that constitute the interconnectedness of business and IT. Following Wagner et al. (2014), these components

can be structured along the three dimensions of social capital: structural linkages, relational linkages, and cognitive linkages. The components and related dimensions are summarized in Table 4 and briefly introduced below, and social capital theory is discussed in greater detail in Section 2.3.1.

Structural interconnectedness is commonly evaluated by analyzing communication patterns. These patterns refer to the type and frequency of formal and informal interactions between operational staff of both domains and constitute “the paths along which business and IT employees communicate and whom they involve in such communication” (Zolper et al. 2013, p. 334). The literature reviewed indicates that strong structural linkages facilitate OBITA processes (Benbya and McKelvey 2006; Martin et al. 2008; Tarafdar and Qrunfleh 2009; Vermerris et al. 2014; Wagner et al. 2014; Wagner and Weitzel 2012). Moreover, it is found that these linkages are strengthened, among others, by frequent formal and informal meetings and dedicated interface actors (Wagner et al. 2014; Zolper et al. 2014).

Though frequent formal and informal interactions are necessary for aligning business and IT, the relational quality of these interactions has also been found to be critical (Wagner et al. 2014). Relational linkages refer to mutual trust and respect as well as shared beliefs and values that characterize the interactions and determine the willingness to define and act on collective goals and share critical resources such as knowledge (Nahapiet and Ghoshal 1998). Prior research show that mutual trust and respect is a key component of social OBITA (Martin et al. 2008; Wagner et al. 2014; Wagner and Weitzel 2012).

Lastly, whether social relations can be effectively mobilized is also contingent the ability to do so, that is, on the cognitive linkages among the actors. Most of the research that focuses on social OBITA evaluates cognitive linkages by looking at shared understanding between business and IT professionals (Benbya and McKelvey 2006; Gerow et al. 2014a; Martin et al. 2008; Schlosser et al. 2015; Vermerris et al. 2014; Wagner et al. 2014 ; Wagner and Weitzel 2012). Such understanding refers to a common base of knowledge and perspectives of both domains and involves the ability of actors to combine of complementary knowledge (Wagner et al. 2014).

Table 4: Social components of OBITA

Concept	Used/discussed by
Structural interconnectedness	
<i>Communication patterns</i> refers to the frequency and type of formal and informal interactions between operational staff of both domains	Benbya and McKelvey (2006) Martin et al. (2008), Tarafdar and Qrunfleh (2009), Vermerris et al. (2014), Wagner and Weitzel (2012), Wagner et al. (2014)
<i>Interface actors</i> refers to people that interact frequently with staff from the other domain (existence and strength of connections)	Zolper et al. (2014)
Relational interconnectedness	
<i>Mutual trust and respect</i> reflect the relational quality of interactions between operational staff of both domains	Martin et al. (2008), Wagner and Weitzel (2012), Wagner et al. (2014)

Concept	Used/discussed by
<i>Cognitive interconnectedness</i>	
<i>Shared understanding</i> refers to a common base of knowledge and perspectives of both domains; this encompasses combination of complementary knowledge:	Benbya and McKelvey (2006), Gerow et al. (2014a), Martin et al. (2008), Tarafdar and Qrunfleh (2009), Schlosser et al. (2015), Vermerris et al. (2014), Wagner and Weitzel (2012), Wagner et al. (2014)
<i>IT domain understanding</i> involving knowledge about technology and processes	
<i>Business domain understanding</i> involving knowledge about business processes, contributions and challenges	

Though prior research investigates both dimensions of OBITA, knowledge concerning the interrelation of both dimensions is limited. Among others, this is found to be related to an unclear differentiation between the dimensions of alignment (Gerow et al. 2016). Defining social alignment as “the state in which business and IT executives within an organizational unit understand and are committed to the business and IT mission, objectives, and plans” (Reich and Benbasat 2000, p. 82), some studies investigating OBITA limited their focus on the higher-level echelons of an organization (Gerow et al. 2016; Gerow et al. 2014a). The fact that this conceptualization of the social dimension is not concerned with the operational level may explain the mixed outcomes concerning the relationships between the two dimensions. Other studies concerned with OBITA focused on the social dimensions of OBITA and its influence on performance outcomes but did not investigate if and how this effect is mediated by the functional dimension (Benbya and McKelvey 2006; Martin et al. 2008; Schlosser et al. 2015; Vermerris et al. 2014; Wagner et al. 2014). Thus, though there is evidence that both dimensions interrelate, there is a gap in research concerning if and why social alignment influences functional integration (Gerow et al. 2016).

2.2.3 Effects of OBITA

The meta-review conducted by Gerow et al. (2014a) provides compelling evidence that alignment is an important determinant of various aspects of organizational performance. Concerning the operational dimension, they show that there are strong relationships between OBITA and a firm’s productivity. Moreover, Gerow et al. (2014a) provide evidence that OBITA increases efficiency of operations, which leads to lower costs and eventually more competitive prices, among others. Similar empirical findings on the effect of OBITA on an organization’s efficiency are provided by Bharadwaj et al. (2007), Gerow et al. (2016), Rivard et al. (2006), Lee et al. (2008), and Wagner et al. (2014).

The literature also indicates that the effect of OBITA on organizational performance is mediated by the efficiency of IT utilization within an organization. The way IT is related to complementary business resources and the way it is used within firms seems to be related to the value it provides (Rivard et al. 2006; Schlosser et al. 2015; Vermerris et al. 2014; Wagner et al. 2014). For instance, Wagner et al. (2014) conclude that social OBITA drives the extent to which a firm deploys IT assets to support operational tasks and increase operating efficiency. Moreover, Bharadwaj et al. (2007) show that tightly integrated IS and business processes facilitate efficient flow of information within complex supply-chains.

Prior work on OBITA further reveals that the efficiency of IT usage is strongly related to an organization's ability to adapt its IT resources and infrastructure to changes occurring within the organization and its environment (Vessey and Ward 2013). For instance, Zolper et al. (2014) show that social OBITA influences the degree to which IS are efficiently changed during daily operations, which, in turn, is strongly related to the business value of these IS. Likewise, Martin et al. (2008) show that social OBITA relates to the ability of IT to implement IT change requests accurately and in a timely fashion. Thus, there is convincing evidence that cross-domain interconnectedness increases an organizations ability to adapt IT to a changing environment and thus facilitates OBITA processes such as IS implementation and change projects. Table 5 summarizes the effects of OBITA that were theoretically discussed or empirically analyzed by the papers included in this literature review.

Table 5: Summary of the effects of OBITA as analyzed by prior research

Outcomes of OBITA	Used/discussed by
<i>Ability to adapt IT</i> refers to the capacity of a firm to efficiently evolve IT assets and infrastructure with changes occurring in the organization and its environment (primarily attributed as an outcome of the social dimensions of OBITA)	Martin et al. (2008), Vessey and Ward (2013), Zolper et al. (2014)
<i>Organizational performance</i> refers to a firm's competitive efficiency and effectiveness (as reflected, e.g., by profits or stock values)	Benbya and McKelvey (2006), Bharadwaj et al. (2007), Burton-Jones et al. (2013), Gerow et al. (2016), Gerow et al. (2014a), Rivard et al. (2006), Lee et al. (2008), Wagner et al. (2014)
<i>Efficiency of IT</i> refers to the internal business value of the IT assets implemented and used at the organization (as reflected, e.g., by facilitated business processes, improved decision-making, and increased coordination flexibility)	Lee et al. (2008), Rivard et al. (2006), Schlosser et al. (2015), Vermerris et al. (2014), Wagner et al. (2014)

2.2.4 Summary

While the strategic perspective on alignment focuses primarily on strategy and high-level executives, OBITA focuses on line employees and day-to-day business including IT projects and operations. The literature conceptualizes OBITA as the process of integrating functional and/or social aspects of business and IT or its outcome.

The processes involving integrating functional aspects of business and IT at the operational level center on reconfiguring organizational structures, processes and related IT assets (Baker et al. 2011). The outcome of these processes is a tight integration of business structures and processes with IT infrastructure and processes, so-called functional integration (Henderson and Venkatraman 1999). The review of the literature indicates that achieving and maintaining elevated levels of OBITA requires the ability to efficiently adapt IT assets and infrastructure to changes occurring within the organization and vice versa. The ability to adapt business and IT structures and processes, in turn, is found to be contingent on the social dimension of OBITA, which refers to strong cross-domain interconnectedness between

IT and business professionals at structural, relational and cognitive levels (Wagner et al. 2014). The ability to adapt business and IT structures and processes and strong cross-domain interconnectedness are both found to significantly influence bottom-up alignment processes (Vessey and Ward 2013). Figure 4 summarizes the key findings of relevant prior literature and depicts the relationships between the key constructs.

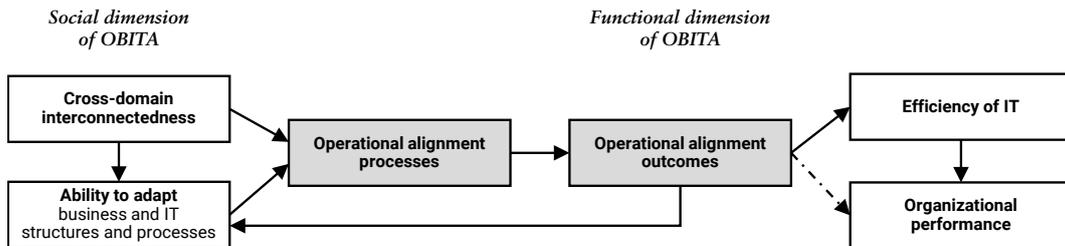


Figure 4: Nomological network of operational business-IT alignment

2.3 Theoretical Perspectives

As discussed above, Prior literature reveals that cross-domain interconnectedness and the ability to adapt business and IT are key to OBITA processes and the outcomes of these processes. Cross-domain interconnectedness between individuals concerned with IT architectures and processes and individuals utilizing IT to complete a professional task constitute the social aspects of OBITA. The ability of organizations and teams to adapt business and IT structures and processes has been shown to be contingent on shared understanding (Benbya and McKelvey 2006; Gerow et al. 2014a; Martin et al. 2008; Schlosser et al. 2015; Vermerris et al. 2014; Wagner et al. 2014; Wagner and Weitzel 2012). Shared understanding and other collective information processing mechanisms reflect cognitive aspects of OBITA that are commonly discussed under the umbrella of shared cognition (Schegloff 1991). The nine papers included in this thesis aim to enhance our understanding of the nature of these social and cognitive aspects and the way they influence OBITA processes and outcomes in ‘decoupled’ organizations like German hospitals. To this end, several theoretical perspectives are triangulated and augmented. This section introduces and justifies the major theories that are applied and adapted to achieve this goal.

2.3.1 Social Capital Theory

Prior research indicates that the concept of social capital provides a sound theoretical lens for studying the nature and effects of cross-domain interconnectedness between business and IT at the operational level (Schlosser et al. 2015; Wagner et al. 2014; Zolper et al. 2014). Researchers from different disciplines such as sociology, economics, and political science literature have used the concept since the early twentieth century (Portes 1998).

The social capital theory (SCT) was developed principally by Loury (1977), Bourdieu (1986), Coleman (1988), and Burt (1997). During the last decades, the concept of social capital has increasingly informed organization and management science (e.g., Hansen et al. 2001; Leana and Buren 1999; Nahapiet and Ghoshal 1998; Nooteboom 2001; Reagans and Zuckerman 2001; Tsai 2000). The concept’s increasing popularity across diverse fields of study and even

in everyday language, however, has led to ambiguity and inconsistency. Some researchers have even expressed concern that the concept “comes to be applied to so many events in so many different contexts as to lose any distinct meaning” (Portes 1998, p. 2).

Looking at different conceptualizations of social capital in sociology as well as organization and management research literature reveals that the idea that the goodwill of others is a valuable resource is common to most research drawing on social capital theory (Adler and Kwon 2002). Consequently, definitions typically include an emphasis on resources that enable the achievement of interests “that in its absence would not be possible” (Coleman 1988, p. 98). Furthermore, it is assumed that these resources are located in networks “of more or less institutionalized relationships of mutual acquaintance and recognition” (Bourdieu 1986, p. 249). Thus, in a scientific context, social capital usually refers to the value of resources that an actor or a group can mobilize through their social relations (Peppard 2007).

Considering the characteristics of these social relations, two views emerge. The first perspective, represented by Coleman (1988), argues that the strength of the relationship between actors determines the value of social capital. Cohesion of social networks facilitates the creation of social norms, trust and sanctions within networks (Coleman 1988). Thus, highly cohesive networks benefit from effective coordination and increased willingness to engage in exchange processes (Burt 2001; Coleman 1988; Reagans and Zuckerman 2001). However, a second perspective argues that strong relationships are not always efficient for exploiting heterogeneous resources (Granovetter 1973; Reagans and Zuckerman 2001). Representatives of this perspective such as Burt (1992) argued that the value of social capital rather arises from opportunities to bridge disconnections or non-equivalencies in social structure. Such interactions across communities enable access to diverse sets of resources (Reagans and Zuckerman 2001). However, it is also acknowledged that disconnections impede communication and coordination (Burt 2005).

Integrating both views leads to a perspective which views social capital as a resource that balances access to non-redundant resources and the ability to efficiently leverage these resources within social networks (Nahapiet and Ghoshal 1998). Social capital is theorized as three-dimensional construct that encompasses structural, relational, and cognitive linkages (Adler and Kwon 2002; Nahapiet and Ghoshal 1998). The structural linkages within social networks reflect its gestalt, which creates opportunities to access and leverage external resources. The relational dimension reflects the extent to which a social network is characterized by a common identity and involves mutual trust, shared norms, and commitment to the common good. Relational linkages determine the willingness to define and act on collective goals within a social network. Last not least, the cognitive dimension impacts the ability to leverage the resources available in a network. The cognitive dimension particularly involves shared codes and language and common frames of reference. These enable actors to understand and utilize what is shared. Furthermore, research on social capital admits that structural, relational and cognitive dimensions are interrelated and to some degree mutually reinforcing (Nahapiet and Ghoshal 1998).

Prior research in organizational sciences and IS demonstrates that social capital is important for integrating knowledge of actors from distinct fields and thus creating new intellectual capital such as shared understanding. For instance, Newell et al. (2004) show that strong relational linkages within IT project teams facilitates knowledge integration and the

formation of a shared sense of purpose and mutual understanding. In IS research, Wagner et al. (2014) as well as van den Hooff and de Winter (2011) show that social capital has considerable influence on knowledge sharing between business and IT professionals in daily business operations. Furthermore, a study by Karahanna and Preston (2013) indicates that social capital enables the exchange and integration of strategic knowledge between IT and business executives.

Building upon the arguments of social capital theory and the findings of the structured review of literature on OBITA, it can be argued that strong structural, relational, and cognitive linkages are of value for OBITA. As these linkages provide opportunities, foster motivation and enable staff from both domains to exchange and combine their distinct knowledge, they are found to impact the ability of a firm to efficiently adapt business and IT infrastructures (van den Hooff and de Winter 2011; Wagner et al. 2014; Zolper et al. 2014). Moreover, social capital is found to increase the likelihood of appropriate OBITA processes (Wagner et al. 2014).

Strong linkages between different occupational groups seem to be particularly important for the healthcare context, where activities require significant coordination, interdependence and interactions among an array of professional groups, disciplines, and instruments, and the interrelations between actors (Greig et al. 2012). Thus, efficient identification and implementation of necessary adaptations to IT and the complex and fragmented activities requires IT, medical, and administrative staff to share their heterogeneous knowledge and experiences on the specifics of healthcare activities and the possibilities and limitations of HIS (Lapointe and Rivard 2005; Poon et al. 2004). One focus in this dissertation is thus to analyze how cross-domain interconnectedness within ‘decoupled’ organizations, particularly between medical and IT professionals, impacts OBITA processes and outcomes. As a means to examine the constituents and channels for knowledge transfer (Subramaniam and Youndt 2005, p. 452), social capital theory offers a meaningful analytical framework to assess the interconnectedness between business and IT at the operational level.

2.3.2 Shared Cognition

As argued above, the ability to efficiently adapt business and IT such as they are sufficiently integrated requires business and IT professionals to exchange and combine their knowledge, expertise, and expectations (Rousse and Deltour 2012). Ultimately, these knowledge integration processes lead to a sufficient degree of shared understanding concerning the necessary adaptations of business and IT infrastructure and processes. The creation of such understanding is the central subject of matter of research on shared cognition. This section introduces and discusses the key concepts of shared cognition in IS.

It has often been argued that an understanding of reality is primarily constructed in the mind of the individual. One theory is that we understand reality by organizing and combining new experiences with existing experiences and knowledge (Vygotsky 1978). This implies that there is no single, objective, true understanding of reality, “but rather different conceptualizations that may ‘fit’ reality better or worse” (Bittner and Leimeister 2014, p. 116). In terms of OBITA, the ability to efficiently adapt business and IT such that organizational performance increases requires conceptualizations that fit reality well. This can be achieved by combining and aligning multiple individual conceptions of organizational reality (Edmondson et al. 2007; Yang et al. 2008).

There is empirical evidence that individual understandings of reality converge and become more accurate over time (Levesque et al. 2001). In particular, frequent interaction among people from different domains as enabled by cross-domain interconnectedness is found to facilitate the alignment of individual conceptions of reality (Bittner and Leimeister 2014). As said, such processes of intertwining thinking processes are commonly discussed under the umbrella of shared cognition (Schegloff 1991). Shared cognition reflects human capacity to engage in larger systems of information processing and to leverage various experiences with and knowledge about an object of interest (Hazlehurst et al. 2008; Mathieu et al. 2000). Moreover, shared cognition is expected to foster the ability of teams to describe, explain, forecast and shape developments in their mutual environment (Mathieu et al. 2010).

Outcomes of shared cognition are inconsistently labeled in different research streams (Bittner and Leimeister 2014). However, since they all reflect outcomes of joint information processing mechanisms, concepts like shared understanding and shared mental models are conceptually significantly similar (Cannon-Bowers and Salas 2001; Cannon-Bowers et al. 1993; Levesque et al. 2001). For instance, shared understanding commonly refers to “the overlap of understanding and concepts among group members” (Mulder et al. 2002, p. 36) and is usually defined as the extent to which a basic understanding of a common subject matter exists that is shared by a group (Tesch et al. 2009). Correspondingly, the concept shared mental model refers to knowledge structures of a group that enable them to develop congruent and accurate explanations of and expectations about the object of interest, such as a joint task (Cannon-Bowers et al. 1993). Both concepts are expected to function as meta-level systems that coordinate and supervise the knowledge of individual actors in order to achieve organizational objectives (Yang et al. 2008).

Regarding OBITA, critical outcomes of shared cognition are joint viewpoints concerning necessary adaptations of business and/or IT infrastructure and processes and shared expectations concerning the effects of these adaptations. Prior literature shows that shared mental models and shared understanding enable teams to create and adapt IT artefacts that are well aligned with existing and emerging structures and processes (see e.g. Faraj and Sproull 2000; He et al. 2007; Hsu et al. 2014; Levesque et al. 2001; Tesch et al. 2009). Thus, shared cognition is a significant aspect of the ability to adapt business and IT structures and processes.

Although there is a significant amount of research on shared cognition in IS, scholars have not yet precisely defined the kind of knowledge and experiences these collective information processing mechanisms need to cover. Most research simply assumes that cross-functional initiatives require shared understandings concerning the task, the way the task is approached, and the team (Bittner and Leimeister 2014; Cannon-Bowers et al. 1993). Beyond these broad categories, IS research has cast little light on the detailed kind of knowledge and experiences that need to be shared during OBITA processes (Bittner and Leimeister 2014), which involve adapting IT and business structures and processes to ensure an optimal fit between IS-related processes and the business context, such as existing and emerging practices. Thus, shared understanding that facilitates these processes most likely needs to cover the opportunities and constraints offered by the socio-organizational context where IT is used as well as the IT infrastructure and processes. The actors involved in OBITA processes must have some basic shared understanding of what can and should be adapted to improve operational integration of business and IT.

Cultural historical activity theory (AT) provides theoretical and analytical tools that describe the socio-organizational context of the business and the IT domain, their interrelations and co-evolution. Thus, it could be expected that AT improves on the cumulative understanding of what needs to be recognized, shared, and considered during IS implementation.

2.3.3 Cultural Historical Activity Theory

Stemming from the work of Vygotsky (1978) and Leont'ev (1978), cultural historical activity theory assumes that human activity is always directed toward the fulfilment of a collective motive, which is to satisfy a need through a mutual object (Engeström 1987). Reflection of and expectation to this object provides answers to the questions of *why* individuals engage in an activity. The activity is carried out through social actions that are performed in an activity system, which regulates *what* actions ought to be taken.

Introducing activity systems as an analytical concept, activity theory offers a reasonable compromise between the two opposite extremes of ignoring the context of social action (the actor-environment system) and extending context to the point where it becomes overly complex and unmanageable (Kaptelinin et al. 1995; Kuutti 1991). As the primary unit of analysis, the activity system covers how man-made artifacts and social conventions govern the collective work of diverse actors to achieve an desired outcome through the production of a material or ideal *object* (Engeström 2001). The object of a collective activity reflects both what motivates people to engage in an activity and what is being transformed to achieve the outcome (Kaptelinin 2005). In addition to the shared object, the activity system comprises the people who are working on the object (the *subjects*), technology and other material or cognitive artefacts employed to achieve the desired outcome (the *instruments*), explicit regulations, policies, and conventions as well as the implicit social norms, standards, and relationships govern collective work (the *rules*), the horizontal division of tasks between actors and the vertical division of power and status (the *division of labor*), and the wider *community* of individuals and subgroups that focus at least some of their effort on the object (Engeström 1987; Engeström 1999; Kaptelinin 2005; Nicolini et al. 2012). Within these complexities, the object of an activity takes shape and acquires its value by being transformed through the actions of and interactions among the members of the activity system (Engeström 1999). Thus, individual actions become meaningful only by considering the culturally developed division of labor, rules, and traditions of collective activities (Mogensen 1992).

In medical activities in hospital, for instance, the mutual object is commonly the treatment of patients. The actions and interactions of healthcare professionals are directed towards developing and implementing treatment plans aimed at restoring good health or alleviating suffering. Besides patients' wellbeing, the intended outcome of medical activities typically involves improved quality outcomes and sufficient revenue streams. Such outcomes are important not only to healthcare professionals, but also to a community including patients, other caregivers, researchers, tax payers and government agencies. The interrelations between healthcare workers, the community and patients are mediated by an array of instruments including HIS and governed by regulations and norms, as well as established roles and responsibilities. Below the activity system components as depicted Figure 5 in are introduced in greater detail.

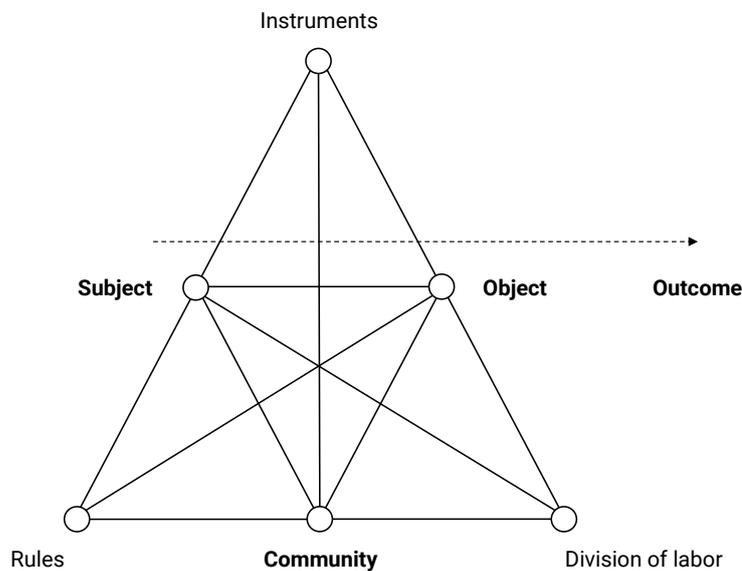


Figure 5: Activity system diagram according to Engeström (1987)

First, AT distinguishes between individual goal-directed action and collective object-oriented activity (Engeström 1999). While individual actions are goal-directed, collective activity is always oriented towards an object (Leont'ev 1978). The object refers to a physical or cognitive entity that is under construction and constitutes the purpose of human activity. It takes shape and acquires value by moving from potential 'raw material' or 'problem space' to the desired outcome (Engeström 1999; Engeström 2001). Moreover, the object determines individual goals and actions through which it may be achieved (Engeström 1999).

Second, AT states that activity is mediated in nature. Humans employ cognitive and physical artefacts to realize the outcome of their activities more efficiently (Blackler 1993; Engeström 1995). These instruments empower humans with experience and skills that were collected in the past (Vygotsky 1978). In addition to enabling the subject to fulfill their intention with the object, instruments also enable the subjects to experience the object, but also restrict the actions and interactions of individuals in terms of the inherent qualities of the artefacts. (Kuutti 1996). Subsequently, a tenet of AT is that the outcomes of human activity are contingent on the capability and availability of the mediating artefacts employed, including IT.

Third, by taking the community and the culturally established rules and the division of labor into account, AT goes beyond dualistic subject-object structures of human action (Mogensen 1992) and acknowledges that individual action is mediated by the larger social context (Engeström 1987). As to that, AT assumes that the object not only drives the subject, but also stimulates and organizes the community that revolves and evolves around it (Kaptelinin 2005; Nicolini et al. 2012). The relationship between the subject and the community as well as their actions and interactions is shaped by and shapes the rules and the division of labor over time.

Besides introducing activity systems as an analytical tool for studying collective activity, AT also draws attention to the developmental nature of human activity. According to Engeström

(2001), human activity systems are constantly passing through iterative series of qualitative transformations, ultimately leading to culturally more advanced systems. The primary forces behind these transformations are the internal and external contradictions activities are subjected to. Contradictions “manifest themselves as problems, ruptures, breakdowns, and clashes” (Kuutti 1999, p. 34) and stem from the multiplicity of actors and goals (Engeström 1999). Contradictions surface when individuals perceive difficulties in constructing a connection between the goals of their individual actions and the emergent object of the collective activity (Leont’ev 1978; Leontjev 1981).

AT provides instruments for understanding the connection between individuals and the collective work activities they are engaged in, the socio-organizational context in which IT-usage takes place, and the position IT occupies as a mediating instrument within these activities. Likewise, AT offers an understanding of how collective IT-mediated activities evolve over time. Prior research demonstrates that AT enhances our understanding of OBITA processes, particularly technology-mediated organizational change (Allen et al. 2013a) such as creating, adapting and implementing novel IT artefacts (Bai 1997; Béguin and Rabardel 2000; Bertelsen 2000; Mogensen 1992), analyzing and adapting complex work-practices (Bernard et al. 2006; Helle 2000; Sadeghi et al. 2014; Spasser 2000), and bridging boundaries between occupational communities (Fitzpatrick 2000).

Research shows that AT deepens our knowledge about the context of IT usage (e.g., business structures and processes). According to AT, context is a dynamic and changing environmental variable that is a result and, at the same time, a determinant of human action. That is, “present context is a result of the social pressures of the past and past actions, giving rise to current practices and meanings, and it creates a cultural environment that impacts on [sic] the available courses of action for the future” (Allen et al. 2011, p. 784). It has been shown that OBITA processes such as information system development are contingent on a basic understanding of the context of affected work activities (Korpela et al. 2000; Mogensen 1992).

Second, AT recognizes that mediation is an important aspect of work activities. Mediation determines the realization of the object and explains the cultural-historical influences of work activities (Allen et al. 2011). Artefacts such as business and IT infrastructures and processes have been and are created during work activities and “carry within themselves a particular culture—a historical residue of that development” (Kuutti 1996, p. 26). The ability to efficiently integrate business and IT infrastructure, thus, seems to require a basic understanding about how IT is enabling and limiting the scope of work activities within existing structures. Prior research shows that AT may enhance our understanding of how and why IT should be integrated within structures and processes that characterize these activities.

Third, IS must satisfy the need of actors within multiple work activity systems of organizations (Almeida and Roque 2000). The object of OBITA processes such as IS development is a moving target. As the organization evolves, the IS must co-evolve with its activity systems. Béguin and Rabardel (2000), for instance, show that design and implementation of new IT-based instruments also involves social construction of utilization schemes. If there are congruencies within and between the elements of activity systems, preproduction of utilization schemes are likely. In contrast, contradictions and tensions, particularly tensions related to the multifaceted object of the activity, impede stable integration of IT-based tools subsequent to adaptation of the activity system (Helle 2000).

Overall, contradictions within activity system have been found to be useful as an analytical lens related to IT-related organizational change (Allen et al. 2013a).

2.3.4 Summary

An analysis of the literature shows that SCT is a meaningful theoretical lens for investigating cross-domain interconnectedness between business and IT – an important enabler of OBITA processes. Analyzing structural, relational, and cognitive linkages seems to be particularly of value in hospitals, where organizational structures do not support strong relationships between medical, administrative and IT professional (Doege and Martini 2008). However, prior research has not analyzed whether social capital can explain the efficiency of OBITA processes and their outcomes.

The fact that the ability to adapt business and IT infrastructures and processes is contingent on shared understanding underscores the importance of the cognitive aspects of OBITA. Heeks (2006) argues that, in the healthcare sector, insufficiently integrated HIS and medical work activities (e.g., HIS failures) stem from a lack of shared understanding grounded in divergent objectives, rationalities and perspectives of the professional groups involved in medical activities regarding the organization and its activities. Although this is a problem other large organizations face as well (Boland and Tenkasi 1995; Dougherty 1992), the divergence of perspectives in hospitals is additionally fostered by the distinct social structures at play in them.

To efficiently adapt medical and IT infrastructures and processes, IT professionals must understand the specifics of the administrative and medical domains (Köbler et al. 2010). Likewise, administrative and medical actors may need to consider the technical, medical or managerial aspects of healthcare delivery (Heeks 2006). OBITA thus seems to require involved actors to share their perspectives and idiosyncratic knowledge and to develop a shared understanding of the objectives and desired outcomes of OBITA processes (Robert et al. 2008; Tiwana and McLean 2005) and eventually to ensure the best possible patient care through efficient processes.

As stated above, however, prior research has not precisely defined the ideal scope of shared understanding to facilitate the harmonization of business and IT at the operational level. Activity theory can improve our understanding of the socio-organizational context, the mediating-nature of IT within work activities and the role of contradictions within work-activities.

2.4 Research Questions

This section summarizes the theoretical foundations of this research and uses the literature review on OBITA to identify emergent gaps in our understanding about how HIS design and implementation and the contextual characteristics of healthcare delivery in hospitals can be aligned. Based on the research gaps identified, detailed research questions are derived that contribute to the overall research objective of this dissertation.

As laid out above, there is compelling evidence that information technology (IT) is likely and expected to improve the performance of healthcare systems around the world (Gauld et al. 2014). However, the outcomes of implementing such technologies are mixed (Cresswell and

Sheikh 2013; Jones et al. 2014; Kilsdonk et al. 2016). Prior research indicates that HIS are seldom well aligned with the needs and characteristics of prospected users and socio-organizational elements of the healthcare sector (Tan and Or 2015) but also that healthcare professionals' contextual realities are crucial to explaining OBITA outcomes such as efficient HIS usage (Mettler et al. 2017) and thus to realizing HIS potentials to increase efficiency and quality of care (Erstad 2003; Greig et al. 2012; Hillestad et al. 2005). Furthermore, insufficient examination of the contextual peculiarities was found to limit our understanding about why systems that work well in one setting may fail in another (Fichman et al. 2011; Jones et al. 2014). In particular, IS research has not yet focused on the mutual interplay between HIS and clinical structures and processes (Abouzahra et al. 2015). Indeed, scholars have called for theory-driven research that explores the roles HIS plays in healthcare considering its distinct organizational and social characteristics (Fichman et al. 2011; Strong et al. 2014).

OBITA research also reveals that our understanding on the mechanisms and outcomes of business-IT alignment at the operational level is limited, that research on this topic is still nascent and that greater use of well-established theories is needed (Chan and Reich 2007b). By triangulating multiple established theories and focusing on the integration of HIS and the organizational structure and processes of healthcare delivery, this cumulative dissertation aims to improve the knowledge in two important overarching areas: (1) identification of characteristics of the healthcare sector, particularly hospitals that relate to the facilitators, processes and outcomes of HIS implementation and use and (2) development of a theory-driven understanding of OBITA processes and outcomes. Findings in these areas are expected to offer much needed guidance for integrating HIS in the complex operational setting of healthcare delivery and thus help answering the overarching research question.

As indicated in Section 2.1, the understanding of the nature of misalignments between HIS and organizational structures and processes that relate to contextual specifics of healthcare is limited (Abouzahra et al. 2015). However, the impact of the interplay between contextual peculiarities and IT may be even higher than in other contexts because of the significance of historically established social structures such as distinct hierarchies and professionalism (Fichman et al. 2011; Halford et al. 2010). Moreover, much research on organizational issues in the implementation of HIS does not concern the German healthcare system (Cresswell and Sheikh 2013). A first step in reaching the research goals is to identify dominant operational misalignments between HIS and the structures and processes of healthcare delivery in German hospitals. Consequently, the first detailed research question (RQ) is:

RQ 1: What kinds of operational misalignments specific to the healthcare context negatively impact efficiency of HIS in German hospitals (e.g., diffusion and effective use)?

The 'decoupled' nature of German hospitals and the distinctive boundaries between physicians, nurses and administrative staff (Doege and Martini 2008) are expected to amplify general difficulties of integrating idiosyncratic knowledge across diverse occupational communities (Pinto et al. 1993). There is evidence that hospitals find it particularly difficult to integrate technical, managerial and medical points of views (DesRoches et al. 2008; Goh et al. 2011). HIS is expected to contribute to meeting the needs of diverse professional groups and specialized disciplines in the hospital setting. One challenge to understanding these needs is that such knowledge is often "socialized, embedded and invested in practice" (Carlile 2002,

p. 442), such as information about routines that are at the core of daily operations in hospitals and information about the ability and limitations of HIS in terms of supporting these routines (Goh et al. 2011).

The review of OBITA reveals that the ability to efficiently adapt business structures and processes with IT is contingent on strong cross-domain interconnectedness between IT and business stakeholders at structural, relational and cognitive levels (Wagner et al. 2014). Moreover, prior research already indicates that social capital provides a sound theoretical lens for studying the nature and effects of cross-domain interconnectedness between business and IT staff at the operational level and that social capital facilitates OBITA processes (Schlosser et al. 2015; Wagner et al. 2014; Zolper et al. 2014). However, research has not explicitly shown how and why social capital facilitates OBITA, particularly in ‘decoupled’ organizations like hospitals. To deepen our understanding about how this structural characteristic of hospitals can be mitigated, this research asks:

RQ 2: How and why does cross-domain interconnectedness facilitate OBITA processes (i.e., the integration of business and IT structures and processes) in ‘decoupled’ organizations like hospitals?

Most of the research that focuses on social OBITA evaluates the ability to align business and IT by looking at shared understanding between business and IT professionals (Benbya and McKelvey 2006; Gerow et al. 2014a; Martin et al. 2008; Schlosser et al. 2015; Vermerris et al. 2014; Wagner et al. 2014 ; Wagner and Weitzel 2012). Such understanding refers to a common base of knowledge and perspectives in both domains (Wagner et al. 2014), which requires the various stakeholder to share their perspectives, negotiate meanings, and agree on a mental representation they want to follow (Bittner and Leimeister 2014).

Considering the complexities of the healthcare domain, prior research shows that the design and functionalities of HIS and evolved structures and processes need to be aligned carefully (Ammenwerth et al. 2006; Goh et al. 2011) to ensure that the HIS meets local requirements and fits the complex socio-organizational context (Fichman et al. 2011). As discussed above, although scholars agree that such adjustments require consideration of different perspectives and needs (Cresswell and Sheikh 2013; Heeks 2006), our understanding of precisely what needs to be shared during by OBITA processes is limited. To broaden our understanding of this cornerstones of the ability to adapt HIS and healthcare work, this research aims to uncover the nature of shared understanding that allow OBITA process stakeholders to harmonize HIS and the distinct structures and processes of healthcare delivery effectively. Consequently, the third detailed research question is:

RQ 3: What specific types of knowledge and information do IT professionals and medical and administrative staff need to share and understand to improve their ability to align business and IT structures and process effectively?

Though outcome-oriented variance theories are prevalent in alignment research (Chan and Reich 2007b), the literature review shows that technical or social outcomes of alignment are contingent on dynamic and iterative alignment processes of adapting business and IT infrastructure, processes and related capabilities to changing environments (e.g., Benbya and McKelvey 2006; Tarafdar and Qrunfleh 2009; Vermerris et al. 2014; Vessey and Ward 2013; Zolper et al. 2014). However, as discussed in Section 2.2.1, the few papers that adopt a process view on OBITA reveal different and sometimes inconsistent insights into alignment.

Moreover, many theoretical alignment constructs were found to be not very helpful for IT and business executives aiming to detect and overcome misalignment (Luftman et al. 2015). Thus, prior literature concludes that further research is required to resolve competing explanatory approaches to provide and internally consistent explanation of how OBITA occurs in a way that allows actionable recommendations to be derived (Burton-Jones et al. 2013; Luftman et al. 2015).

By integrating the findings of the papers included, this thesis is geared toward the development of the foundations of an integrative process theory of IS-related change aimed at integrating IT and business structures and processes. Based on the insights revealed by the literature review, such a theory first needs to acknowledge that OBITA outcomes are dependent on dynamic processes. Thus, rather than adopting deterministic logic, such a theory should reflect the dynamics of social processes (Markus and Robey 1988). Second, it should explain both bottom-up generative processes and planned top-down management interventions (Vessey and Ward 2013). Third, acknowledging that OBITA is a multidimensional phenomenon (Benbya and McKelvey 2006), the theory should integrate relationships between technological (e.g., Dreiling et al. 2006; Vessey and Ward 2013) and social components of OBITA (e.g., Wagner et al. 2014; Zolper et al. 2014), which are usually analyzed separately. Fourth, the theory should allow OBITA to be conceptualized as a continuous process of mutual adaptation and change (Vessey and Ward 2013) and likewise allow for analyzing OBITA processes as short patterns of radical change triggered by critical events (Burton-Jones et al. 2013). Finally, the theory needs to account for the contextual complexities of the healthcare domain. AT is expected to provide valuable insights into developing such a theory. Thus, the fourth detailed research question is:

RQ 4: How can operational business-IT alignment processes in healthcare be theoretically described and explained so as to derive actionable recommendations?

2.5 Summary

To understand the role of IT in healthcare and the mechanisms needed to effectively integrate these systems into healthcare activities, this section discussed the characteristics of hospitals and HIS as reported in prior research. Moreover, it is shown that harmonizing the capabilities offered by HIS and infrastructures and processes of hospitals, that is OBITA, is key to improving the efficiency of healthcare systems (Gauld et al. 2014). Based on a review of OBITA literature and an in-depth discussion of social and cognitive aspects of OBITA as well as associated theoretical perspectives, research gaps and four detailed research questions were derived, which this cumulative dissertation will attempt based on triangulating multiple theories, research paradigms, and related methods. The following section provides an overview of the research paradigms and methods applied.

3 METHODOLOGY

This dissertation triangulates several theoretical perspectives, research paradigms (e.g., positivist and interpretive) and related research methods (e.g., qualitative and quantitative

methods for data collection and analysis). As with other multi-method research approaches, the triangulation intends to provide a fuller picture of the phenomenon (Johnson et al. 2007) and thus to improve our theoretical understanding of OBITA antecedents, processes, and outcomes in healthcare.

According to Kuhn, paradigms are “universally recognized scientific achievements that, for a time, provide model problems and solutions for a community of practitioners” (Kuhn 1962, p. x). Paradigms involve a set of mutual beliefs and agreements about how problems should be understood and tackled (*ibid.*). Research paradigms provide a model for choosing problems as well as a network of conceptual, theoretical, instrumental, and methodological commitments. More precisely, research paradigms determine, for instance, what is to be observed, what questions should be asked, how the questions are structured, how inquiries should be conducted, and how the results should be interpreted.

According to Guba and Lincoln (1994) paradigms can be characterized by their assumptions about how the world is made up and the nature of things (ontology), how one might discover knowledge about the world (epistemology) and how to go about discovering knowledge (methodology).

Positivists claim that “reality is objectively given and can be described by measurable properties, which are independent of the observer (researcher) and his or her instruments” (Myers 2013, p. 38). Thus, the ontology underlying positivism is that there is a reality beyond inter-subjective meanings, that facts and values are distinct, and that scientific knowledge consists only of facts (Archer 1988). Hence, the focus is on reliable and valid tools to describe the factual reality. Moreover, positivist research usually progresses through hypotheses and deductions. Consequently, dominant research methods are quantitative approaches such as experimental research and survey research (Guba and Lincoln 1994). Several of the studies that comprise this dissertation are based on such positivist research.

In contrast, critical realism assumes that “there is an existing, causally efficacious world independent of our knowledge”, but that our access to this world is limited and “always mediated by our perceptual and theoretical lenses” (John Mingers et al. 2013, p. 795). Critical realism distinguishes between the real world and our knowledge of it. The world is viewed as differentiated and stratified, consisting not only of events, but also of structure. Structure is “a set of internally related objects or practices” (Sayer 2010, p. 92), which have the powers and liabilities to act and cause events. Events, in turn, are the external and visible behaviors of people, systems and things as they occur or occurred. Events are what critical realists investigate to identify causal explanations that identifies the object and mechanisms that connect them and combine to cause events to occur. Thus, the primary object of critical realism is to understand what causes events to happen.

Critical realism has a stratified rather than flat ontology (Bhaskar 1978). The strata are the domains of the empirical, the actual and the real. According to this paradigm, events observable in the empirical domain are only a subset of events occurring in the actual domain. Such actual events are themselves generated by mechanisms belonging to the real domain. In other words, critical realists assume and accept differences between the domains and understand explanations of empirically observable events as interpretations of real-domain mechanisms that generate unobservable actual-domain events that caused the observed events to occur. Consequently, “we see just the tip of an iceberg but that doesn’t mean that

the invisible three quarters is not there or is unconnected to what we see” (Easton 2010, p. 123). In contrast to positivism, critical realism “acknowledges that social phenomena are intrinsically meaningful, and hence that meaning is not only externally descriptive of them but constitutive of them (though of course there are usually material constituents too). Meaning has to be understood, it cannot be measured or counted, and hence there is always an interpretative or hermeneutic element in social science” (Sayer 2000, p. 17).

Critical realism implies that “what can be known is inextricably intertwined with the interaction between a particular investigator and a particular object or group” (Guba and Lincoln 1994, p. 110). Hence, the ontological and epistemological stances of critical realism require methods that enable the researcher to overcome “ignorance and misapprehensions (accepting historically mediated structures as immutable)” and become more conscious about how the structures might be changed and which actions are required to effect change (Guba and Lincoln 1994, p. 110).

Following the arguments above and in line with Walsham (2006), critical realism is viewed as a possible philosophical underpinning of interpretive research, where data collected in the field reflects the researchers’ constructions of other people’s constructions of their actions. This data is mainly qualitative in nature. Developing meaningful interpretations requires a research process that involves deduction, induction, and retroduction (Easton 2010). Deduction provide links with previous research end enables the development of assumptions of what mechanisms may cause observed events, while induction provides data on the events that need to be explained and tests the explanations. Retroduction is a “...mode of inference in which events are explained by postulating (and identifying) mechanisms which are capable of producing them...” (Sayer 2010, p. 72).

This dissertation combines positivism and critical realisms research paradigms and their dominant research methods into a set of related studies. However, the focus lies not primarily on testing causal relationships between predefined variables by means of quantities methods. Rather, most of the studies assume that access to reality is mediated through social constructions such as language, theories, and instruments (Myers 2013, p. 39) and emphasize human sense-making as a phenomenon emerges and try to capture its complexity (Kaplan and Maxwell 2005). Nonetheless, this dissertation does not reject the value of positivistic research, but recognizes that taking a positivistic stance to analyze both quantitative and qualitative data increases breadth and depth of the findings and benefits the contributions.

Adopting a positivistic stance, quantitative and qualitative methods were applied to transfer, test and extend existing theories to OBITA in healthcare, particularly concerning the cause and effect of cross-domain interconnectedness. Further, taking a critical realist stance, several single and multiple-case studies were conducted. These studies aimed at discovering meaningful interpretation of what is going on in the real, actual and empirical strata of reality. Using qualitative methods, these studies attempt to understand the dynamics of the processes and outcomes of OBITA from multiple points of view as well as the significance of cultural, social and institutional structures, which could not easily be achieved by means of quantitative methods. These empirical studies are further underpinned and supplemented by a structured literature review. In the following sections, the methodologies used are discussed in greater detail.

3.1 Literature Review

The literature review conducted within the scope of the dissertation research project is included in the theoretical background section of this introductory paper. This literature review analyzes recent research on OBITA with the objective of identifying what is already known about OBITA, its processes and outcomes in IS research. Considering the specifics of the healthcare domain, particularly the issues related to the diffusion and use of HIS, led to the identification of research gaps (Rowley and Slack 2004). Following the methodology and guidelines proposed by Webster and Watson (2002) and Paré et al. (2016), the review of current literature offers a solid foundation for advancing knowledge, in this case about OBITA in healthcare, and facilitates the development of sound theories (Webster and Watson 2002). The design and process of the literature review is presented below.

First, in accordance with generally accepted norms of a structured literature review, the working review question was formulated (i.e., what are the dimensions, mechanisms and effects of OBITA as reported in the relevant literature?) and an appropriate research method was selected (i.e., a sequential review approach) (Paré et al. 2016). Subsequently, the review protocol that guides the systematic and sequential review process was developed. As shown in the following, the protocol involves, amongst others, the selection of journals, the definition of the time spans the review covers, and the initial search terms.

The concept of business-IT alignment was introduced in IS research (Henderson and Venkatraman 1999). As a comprehensive literature review found that most research in this topic was published in IS journals and leading IS conferences (Chan and Reich 2007a), the scope of the review was limited to the IS field initially. More precisely, the initial search was limited to the eight top IS journals as identified by the AIS Senior Scholars (MISQ, ISR, JMIS, EJIS, ISJ, JAIS, JIT, and JSIS) (Lowry et al. 2013) and the most important IS conference (ICIS)¹ (Association for Information Systems 2017). Moreover, the literature review cited above only identified two studies that do not focus on the strategic level (Chan and Reich 2007b). As the authors of this review conclude that research into business-IT alignment at the operational level is sparse, few additional studies before 2007 would be expected. Thus, the initial search focused on articles published in the last 10 years (01/2007 to 12/2016).

The search terms were defined according to the original definition of OBITA as proposed by Henderson and Venkatraman (1999) and the alignment definitions and equivalent terms as discussed by Chan and Reich (2007b). The keywords were then refined using pre-tests such as discussions with domain experts and initial searches in the selected journals. Ultimately, the following search terms were included: operational, alignment, functional, structural, and integration.

The search process proceeded as follows. First, the archives of the AIS basket of journals and the ICIS proceedings were searched for articles published in or after 2007 that include the defined keywords in their titles, abstracts, and author-supplied keywords. The resulting

¹ According to the VHB-Jourqual 3 ranking, ICIS is the only conference with an A rating Hennig-Thurau, T., and Sattler, H. 2015. "VHB-Jourqual 3 Teilrating Wirtschaftsinformatik," VHB, Köln.

papers were then scanned. If they were thematically consistent with the research objective, they were included in the initial set of papers (n= 44). Second, these articles were read. After analyzing the full texts, 29 papers were found to lack a theoretical or empirical focus on business-IT alignment at the operational level within organizations and were thus excluded. Third, to identify additional articles that fit our research objective, a backward and forward search for the preliminary articles was conducted using the Web of Science² and Google Scholar³. As articles were identified that were not published in a journal included in the AIS basket, the exclusion criteria were extended. To ensure high quality, articles were required to have been peer-reviewed and published in journals with an impact factor greater than 1.0 or presented at conferences with a B or higher rating according to VHB-Jourqual 3 ranking (Rowley and Slack 2004). We also eliminated any articles not written in English or German. Ultimately, 19 papers were included in the review.

To structure the analysis, a concept-centric matrix was iteratively developed. This matrix facilitated identification and analysis of important findings in the articles, such as the definitions used, dimensions covered, and the effects of OBITA. Moreover, figures based on the SAM (Henderson and Venkatraman 1999) were developed to illustrate the major findings. Finally, the relationships between the concepts identified was synthesized by means of a nomological network of operational business-IT alignment (see Section 2.2).

3.2 Quantitative Research

As part of the triangulation strategy of this dissertation, Paper IV takes a positivistic quantitative research approach. A research model was developed, the dependent and independent constructs were operationalized as latent variables, a questionnaire developed and data collected using an online survey. Ultimately, structural equation modeling (SEM) was used to test the hypotheses included in the research model. The rationales for taking a quantitative research approach and the methods applied are explained in the following sub-sections.

3.2.1 Suitability of Quantitative Research

Quantitative research methods are typically characterized by an emphasis on quantitative data and positivist philosophy. In line with the positivist stance, data represent objectively measurable levels of theoretical constructs that are ideally independent of the researcher and his or her instruments (Kaplan and Maxwell 2005). Most quantitative research attempt to follow the “effects-of-causes” approach (Mahoney 2006) and formulate research questions like what is the effect of construct X on construct Y. Consequently, quantitative research typically “seeks to identify causes that, on average, effect (e.g., increase or decrease) the values on an outcome across a large population.” (ibid., p. 232).

² <http://www.webofscience.com>

³ <http://scholar.google.com>

Edmondson and McManus (2007) distinguish theories from each other to determine their suitability of different research approaches. They differentiate mature, intermediate, and nascent theory. Mature theory “encompasses precise models, supported by extensive research on a set of related questions in varied settings. Maturity stimulates research that leads to further refinements within a growing body of interrelated theory” (ibid., p. 1159). Moreover, they conclude that research based on mature theory has a strong methodological fit with quantitative methods such as surveys or experiments for data collection and statistical inference for data analysis. Following the effects-of-causes approach, studies that apply quantitative methods are mainly concerned with variables and the correlations among them (Edmondson and McManus 2007; Markus and Robey 1988). Quantitative methods examine relationships between constructs by analyzing objectively measurable levels and are thus particularly appropriate for validating mature theories and/or developing extensions that may add specificity, new mechanisms, or new boundaries to these theories (Edmondson and McManus 2007). Consequently, Mohr (1982, p. 42) notes that this “model of explanation in social science has a close affinity to statistics. The archetypal rendering of this idea of causality is the linear or nonlinear regression model.”

This type of research is popular in IS research, with many studies developing hypotheses based on mature theories from diverse fields and formally testing them with statistical techniques (Gregor and Klein 2014). In contrast, mixed-method research approaches or qualitative research approaches, respectively, have a greater fit with intermediate and nascent theories. For more details on the suitability of qualitative research please see Section 3.3.1.

Paper IV aims to test an elaborated theory (SCT) in a new setting and to extend and provide additional support for the work of Wagner et al. (2014). More specifically, the paper aims to clarify its suitability to explain OBITA outcomes in German hospitals by investigating the effect of cross-domain interconnectedness on IT business value (i.e., social OBITA). To this end, the research relies heavily on existing constructs and measures, aims to explain how these constructs are related, and focuses on formal hypothesis testing. Thus, a quantitative research approach is appropriate.

3.2.2 The Role of Theory

Regardless of philosophical stance, a key question for researchers relates to the role of theory in their research (Walsham 1995). Doty and Glick (1994, p. 231) define theory as “a series of logical arguments that specifies a set of relationships among concepts, constructs, or variables.” The structure resulting from these arguments provides a lens for viewing or explaining something about the world (Gregor 2006). A major function of theory is thus to provide a model or explanation of why the world is like it is, and how and why things happen (Strauss 1995).

These explanations may either focus on how a phenomenon unfolds (process-type theories) or how theoretical constructs are related (variance-type theories) (Markus and Robey 1988). Variance-type theories are usually tested or developed by analyzing how an increase in one variable is associated with an increase in another variable (Edmondson and McManus 2007; Markus and Robey 1988). Thus, variance-type theories constitute important inputs to and outcomes of quantitative research.

Paper IV draws on the construct proposed by prior research on SCT to conceptualize cross-domain-interconnectedness. More precisely, the paper aims to test how social capital between business and IT units in hospitals relates to the degree to which HIS and clinical structures and processes are aligned and thus create business value. So, Paper IV tests variance-type hypotheses derived from mature theories.

Research approaches that intend to test and/or expand variance-type theories or theoretical relationships are stated before the study (*a priori*) (Edmondson and McManus 2007). In line with the positivist paradigm, theory is regarded as objective knowledge about causal relationships between observable phenomena that exist independent of the observer (Myers 2013). Thus, such research typically follows a deductive process. However, developing theories that can be tested by means of quantitative approaches is viewed as one of the most challenging tasks for researchers. Gregor and Klein (2014) even state that it “is perhaps more of an art than a science.” Some of the issues in developing a theory and how this dissertation addresses them are outlined below.

To produce valuable theoretical contributions, the following theorizing-related obstacles need to be overcome to test variance-based hypotheses. First, the research must be based on sufficiently strong theory development leading to well-conceived research models (Gregor and Klein 2014). In Paper IV, an emphasis is placed both on the literature review and theory development. The literature review identifies prior theory that is relevant to social OBITA as well as recent empirical studies. This allows the hypotheses to be positioned in relation to related research. Moreover, a clear, logical argument that explains why social capital contributes to the alignment of HIS and medical structures and processes as well as IT business alignment was developed.

Second, research need to be aware of the limitations of the research design concerning attribution of causality (Gregor and Klein 2014). Acknowledging these limitations, the effect of cross-domain interconnectedness was investigated taking not only a quantitative approach (Paper IV), but also a qualitative approach (Paper V). Here, a longitudinal design was chosen to reveal if the cause (cross-domain interconnectedness) precedes the effect (alignment of HIS with clinical structures and processes). Other explanations of the cause-effect relationship were also considered.

Third, the meaning and labels of the theoretical constructs need to be precise and must not change throughout a paper (Gregor and Klein 2014). Paper IV provides clear definitions for all constructs of the research model. The paper also tests construct validity (for details see Section 3.2.5) and describes the survey instrument.

In summary, quantitative research typically aims to test and/or enhance variance theory. The theory developed and tested need to build on strong prior theory and empirical evidence (i.e., *a priori* theory development). The constructs need to be clearly defined and hypotheses must follow a clear and logical argument. If the hypotheses are not grounded in strong theory and empirical evidence, the research will likely fail to provide convincing results that offer a valuable contribution to the literature and influence others’ understanding of the topic (Edmondson and McManus 2007). To avoid this, Paper IV follows the advice outlined in the literature.

3.2.3 Instrument Development

Employing appropriate construct measures is critical to building cumulative knowledge by means of hypotheses-testing (MacKenzie et al. 2011). To ensure that proper measurement instruments were used in this dissertation, the research design of Paper IV follows the advice of MacKenzie et al. (2011). First, clear conceptual definitions of the constructs were developed. Second, based on these conceptualizations, already validated scales were identified in the literature and adapted to the context. Third, face validity and content validity was tested during discussions with domain experts (academics and practitioners). To improve on the overall comprehensibility of the items, some items were dropped and the wording of some items was refined.

Most of the constructs included in this study are unobservable and cannot be directly measured. These constructs were operationalized as latent variables where the items are empirically measurable indicator variables. Ultimately, the measurement instrument developed contained three to five of these items for each construct, which are measured on 7-point Likert scales.

Depending on whether the items reflect the construct or form the construct, the measurement instrument should be specified as reflective or formative, respectively (Bagozzi 2011). The definitions of the constructs and the measurement models used by prior literature lead to a reflective measurement for all constructs. The underlying assumption of this measurement mode is that a person's score on the measures is a function of his or her true position on the construct, allowing for error. Thus, the direction of causality is from the latent construct to the indicator (Jarvis et al. 2003), while "each measure is viewed as an imperfect reflection of the underlying latent construct" (MacKenzie et al. 2011, p. 295). Changes in the indicator should not cause changes in the construct. Consequently, indicators are expected to covary with each other, should be interchangeable and, if necessary, could be excluded the ex-post analysis of the measurement model (Jarvis et al. 2003; MacKenzie et al. 2011).

Moreover, to reduce the chance of common method bias in the design of the instrument, the suggestions of Podsakoff et al. (2003) were considered. The scales reflecting the independent and dependent latent constructs were separated by additional questions about the context. Moreover, in the introduction of the questionnaire, anonymity was assured and the participants were asked to answer the questions as honestly as possible. To further increase comprehensibility, an introduction to the context of the survey was given to focus participants' attention on the object of the study. The accompanying texts were also reviewed as part of the expert discussions.

3.2.4 Data Collection

In survey research, "information is generally collected about a fraction of the study population – a sample – but it is collected in such a way as to be able to generalize findings to the population" (Pinsonneault and Kraemer 1993, p. 78). To gather a sample that represents the population of hospitals in Germany, the Bisnode company database was used in Paper IV (Bisnode 2014). This database includes all hospitals in Germany. However, the initial sample was reduced to hospitals for which a IT manager could be identified who could name a physician responsible for the enhancement of HIS at the operational level – the focus of this study.

The demographics of the respondents roughly reflect the distribution of public, non-profit, and for-profit hospitals in Germany (Statistisches Bundesamt 2013). Thus, this sample of hospitals is viewed as suitable to analyze the effects of cross-domain interconnectedness on the alignment of HIS for medical documentation in German hospitals.

3.2.5 Data Analysis

To test the hypotheses, Paper IV uses partial least squares structural equation modeling (PLS-SEM) and the software application SmartPLS (Ringle et al. 2005). PLS-SEM is probably one of the most popular multivariate analysis methods in IS research (Gefen et al. 2011). Multivariate techniques combine “aspects of multiple regression (examining dependence relationships) and factor analysis (representing unmeasured concepts with multiple variables) for testing and estimating the strength of causal relationships (Straub et al. 2004, p. 426). PLS-SEM allows the reliability and validity of the measurements to be tested in parallel to the hypotheses contained in the research model. Like SEM in general, PLS-SEM “allows [for] the creation and estimation of models with multiple dependent variables and their interconnections at the same time” (Gefen et al. 2011, p. iv). Moreover, PLS-SEM and other SEM techniques support latent variables, as used in this research (Hair et al. 2012).

Besides the fit of the characteristics of PLS-SEM outlined above, there are two additional reasons why PLS-SEM was chosen to analyze the data in Paper IV. The first reason relates to the rather small sample size, which is one of the most popular arguments for choosing PLS-SEM (Hair et al. 2012; Ringle et al. 2012). Although PLS-SEM is not immune to the threats inherent in small samples that may inadequately represent the population (Hair et al. 2012), PLS-SEM can be a “silver bullet” in situations where the research model is relatively complex and the representative set of data is rather small (Hair et al. 2011). The second argument relates to the research objectives. Paper IV aims to examine if SCT is a suitable theoretical lens for examining cross-domain interconnectedness in the hospital context and to determine the effects of linkages between business and IT on OBITA outcomes. Though there is much research on social capital in various domains and SCT can thus be considered as mature theory (Adler and Kwon 2002), the research objectives themselves are rather exploratory in nature. Exploratory research and variance-based theory development is an appropriate rationale for using PLS-SEM (Hair et al. 2012).

A structural equation model and thus the analysis of such a model has two components: the measurement model and the structural model (Hair et al. 2011). The measurement model, also referred to as outer model, specifies the indicators for each construct and assesses the reliability of each construct (Straub et al. 2004). The structural model, also referred to as the inner model, shows the relationships (paths) between the latent variables (Hair et al. 2011). Both need to be validated and evaluated based on different criteria. As outlined below, this analysis was conducted following the guidelines available in literature (Gefen et al. 2011; Hair et al. 2012; Straub et al. 2004).

3.2.5.1 Measurement Model Assessment

Before assessing the measurement model of the PLS-SEM the items were subjected to common factor analysis for assessment of unidimensionality (Straub et al. 2004). To this end, factor loadings were examined to ensure that items only load cleanly on constructs upon which they are theorized to load. Items that loaded on constructs upon which they should

not load were excluded. Moreover, as a single informant reported on the independent and dependent variables, it was necessary to examine if CMB is a problem. To this end, Harman's single-factor test and the unmeasured latent marker construct was applied (Podsakoff et al. 2003). Based on the results of both tests, it is inferred that CMB is not of particular concern.

Following the validation guidelines of Straub et al. (2004), Gefen et al. (2011), and Hair et al. (2012), internal consistency reliability, indicator reliability, convergent reliability, and discriminant validity need to be assessed. The criteria and thresholds are summarized in Table 6. The most common measures for internal consistency reliability are Cronbach's alpha and composite reliability (Hair et al. 2012). Both measures indicate to what extent the indicators of a construct have the same range and meaning. Indicator reliability describes the extent to which an item is consistent regarding what it intends to measure. Indicator loadings that are significant and above 0.70 point to indicator reliability. Convergent validity is given if items that reflect the same construct converge in comparison to items measuring different constructs. A commonly applied criterion of convergent validity is the average variance extracted (AVE) measuring the percentage of variance captured by a construct (Straub et al. 2004). Finally, discriminant validity refers to the extent to which the items of a given latent variable differ from those that are not believed to reflect the construct (Straub et al. 2004). To this end, cross-loadings are compared and the loading of each indicator needs to be higher for its assigned latent variable than for any other constructs. According to the Fornell-Larcker criterion, some latent variable needs to share more variance with its assigned indicators than with any other latent variable (Fornell and Larcker 1981). Consequently, the AVE of each construct should be greater than the constructs highest squared correlation with any other latent variable.

Table 6: Criteria for evaluating measurement models (Hair et al. 2014)

Type	Criteria	Guidelines for evaluation
Unidimensionality	Common factor analysis	Items must converge in a single factor so that each item only loads with a high coefficient on the factor that it is supposed to measure
Internal consistency reliability	Cronbach's alpha	> 0.70
	Composite reliability	> 0.70
Indicator reliability	Indicator loadings	Significant and > 0.70
Convergent validity	Average variance extracted (AVE)	> 0.50
Discriminant validity	Indicator loadings	Indicator's loadings > all its cross loadings
	Fornell-Larcker criterion	AVE > the variable's highest squared correlation with any other latent variable

3.2.5.2 Structural Model Assessment

Once it has been shown that the measurement model fulfils the reliability and validity criteria, the structural model can be evaluated (Chin 1998). The two primary criteria for assessing the structural model are the coefficient of determination of each dependent variable in the research model (R^2) and the significance level of each path coefficient (ibid.).

The R^2 measures the relationship of the variance of a latent variable explained by the structural model to its total variance (Chin 1998). Path coefficients represent the hypothesized relationships between the constructs and provide evidence of the quality of the structural model (ibid.). Besides the algebraic sign and magnitude, the significance should be assessed (Hair et al. 2012). Significance levels are commonly calculated using resampling procedures such as bootstrapping (ibid.). Paths that are contrary to assumed relationship and/or do not meet the minimum level of significance, do not support the research model and its hypotheses (ibid.).

Additionally, it is suggested to assess the effect size of each path in the structural equation model (Hair et al. 2014). Cohen's f^2 measures if an independent variable has a substantial impact on a dependent variable (Cohen 1988). The effect size reflects the increase in R^2 if the dependent variable under consideration is added to the model (Chin 1998). The criteria for model validity and related thresholds are summarized in Table 7.

Table 7: Criteria to evaluate the structural model (Hair et al. 2014)

Criteria	Guidelines for evaluation
Coefficient of determination (R^2)	<ul style="list-style-type: none"> > 19% = weak > 33% = moderate > 67% = substantial
Significance of path coefficients	t-values for a two-tailed test: 1.65 = 10% significance level 1.96 = 5% significance level 2.57 = 1% significance level
Sign of path coefficients	According to the theoretically assumed relationship
Magnitude of path coefficients	The closer the coefficients are to 0, the weaker the relationships
Effect size (f^2)	<ul style="list-style-type: none"> > 0.02 = small effect > 0.15 = medium effect > 0.35 = large effect

3.3 Qualitative Research

The literature review on OBITA reveals that research on this topic is still nascent and that there are few relevant mature theories. Particularly, the knowledge on the mechanisms that facilitate efficient integration of business and IT structures and processes is limited. To close this gap, to develop sound theoretical explanations of the OBITA mechanisms at work, and to identify their facilitators, most the papers included in this dissertation apply qualitative research approaches (Papers I-III and Papers V-IX).

More precisely, all qualitative papers except Paper I are single or multiple-case studies. The specifics of case studies are outlined in Section 3.3.2. Paper I, in contrast, focuses on beliefs of individuals concerning the alignment of HIS with medical practices. Data from 16 semi-structured interviews were used to elicit these beliefs. Unless otherwise stated, the methodical details concerning the role of theory, data collection, and data analysis reported below also apply for Paper I.

3.3.1 Suitability of Qualitative Research

While quantitative approaches are applicable for testing well-defined and structured hypotheses, qualitative methods facilitate “data collected in the field to strongly shape the researchers understanding of the phenomenon” (Edmondson and McManus 2007, p. 1159). Qualitative research facilitates the development of explanations of the mechanisms that lead to specific events and outcomes in a local setting (Maxwell 2013). This applied particularly to less researched phenomena where understanding of the perspectives of actors is critical, investigation of the social, organizational, and cultural context is required and where the phenomenon and theories are rather process- than solely outcome-oriented (Edmondson and McManus 2007; Kaplan and Maxwell 2005; Maxwell 2013).

Predating quantitative studies, qualitative studies often aim to improve the learning on subjects that cannot be measured easily. In contrast to quantitative studies that rely heavily on existing constructs and measures (Edmondson and McManus 2007), qualitative methods are helpful for determining what might be important to measure (Kaplan and Maxwell 2005) and thus for identifying antecedents and outcomes of specific phenomena by studying their dynamics in real-life settings.

Moreover, qualitative research is interested in how observed events and outcomes are shaped. Qualitative methods thus aim at a thorough understanding of the context of the phenomena studied as well as the mechanisms that influence these phenomena over time (Maxwell 2013). In contrast to quantitative research approaches, qualitative studies thus typically study a manageable number of individuals or situations. Moreover, they intend to preserve the individual features of these units, rather than collecting data from large sample and aggregating them (Maxwell 2013). In general, applying a qualitative research strategy enables researchers to learn how events, actions, and meanings are shaped by the unique structures in which they occur.

However, qualitative research is not only interested in the physical events, the behaviors being performed and the contextual peculiarities, but also how the involved actors make sense of these and how their understanding influences their behavior (Maxwell 2013). Thus, qualitative research methods are useful when researchers aim to understand what events, situations, experiences, and actions mean for actors involved in the study (Kaplan and Maxwell 2005). This focus on meaning is also central to the interpretive research (Walsham 1995; Walsham 2006) intervening between the domain of the empirical and the actual, which may enrich understanding of the mechanisms at work (Maxwell 2013).

Though qualitative research is not unconcerned with outcomes, its primary focus is on processes as they develop and emerge (Maxwell 2013). A strength of qualitative methods is their capability to improve understanding on the mechanisms that relate objects and shape the events and outcomes. While quantitative studies are particularly useful for analyzing

whether causal relationships exists, qualitative research enables researcher to develop explanations of the mechanisms that led to specific outcomes (Miles and Huberman 1994). Hereby, qualitative methods can lead to theoretical explanations of *how* and *why* processes, events, behavior, and outcomes occur (Markus and Robey 1988).

3.3.2 Case Study Research

Case study research aims at studying a single unit or small number of units (the cases) intensively to understanding a larger class of similar units (a population of cases) (Gerring 2008). Consequently, the case study approach is defined as “an empirical inquiry that investigates a contemporary phenomenon in depth and within its real-life context” (Yin 2009, p. 18). Though it can be difficult to specify the boundaries of the cases, the units analyzed should be spatially and temporarily bounded (Eisenhardt 1989; Yin 2009). Overall, the advantage of case study research is that it can zoom in on real-life situations and test or develop theoretical perspectives in relation to phenomena as they unfold in practice (Flyvbjerg 2006).

According to Yin (2009), case studies are preferred when the research intends to mainly answer “how” and “why” questions, control over actual behavioral events is limited, and the focus is on contemporary events. All three conditions apply to the case studies included in this dissertation. First, the research questions primarily focus on how and why OBITA processes unfold and how and why antecedents of OBITA as identified in prior research facilitate OBITA processes and outcomes. Second, the researchers did not have control over the events and behavior of the people involved in the investigated phenomena, but acted as outside observers. Third, OBITA is a contemporary issue in hospitals.

Traditionally, the case study approach has been associated with qualitative methods (Gerring 2008). Though case studies show a high affinity with qualitative methods, this type of inquiry is not by definition entailed to qualitative methods (Creswell 2007; Gerring 2008) Case study research can rely on qualitative or quantitative methods for data collection and analysis (Eisenhardt 1989). Likewise, it can follow a positivist or interpretivist paradigm, can be deductive or inductive in nature, or even be a mix of these poles (Cavaye 1996).

The methods employed depend on the number of observations employed. This number “may be either small or large, and consequently may be evaluated in a qualitative or quantitative fashion” (Gerring 2008, p. 29). Thus, case studies may employ a vast variety of techniques for data collection and data analysis (Yin 2009). The choice of techniques, however, is not only contingent on the number of observations, but also on the degree to which these observations are comparable (Gerring 2008). To apply quantitative methods, the diversity of information needs to be reduced to conform to uniform parameters. Given the complexity of the contextual conditions in relations to the cases, the case study papers included in this dissertation primarily apply qualitative methods (Papers III, V, VI, VII, VIII and IX). However, Paper II also utilizes quantitative data (number of documents filed in the paper-based record that are also available via the HIS) to assess the degree of effective use of the HIS under investigation.

Regardless of the nature of the data collected and analyzed, the case studies included in this dissertation aimed at gathering rich data on the cases. Therefore, multiple data sources such as interviews, observations, secondary data and more quantitative measures were employed.

Based on these data, single or a small number of cases are intensively studied to identify causal explanations about mechanisms that cause overserved events to occur (e.g., misalignment leading to resistance or ineffective use of HIS) that may also apply to similar cases. Table 8 lists all cases and their data sources.

Table 8: *Case Studies conducted within this dissertation*

Case(s)	Primary Focus	Unit of Analysis	Data Sources	Reported in
Cases A-D	Usage of an HIS within four clinics of a large German teaching hospital (GTH)	Clinic	Documents, observations, informal conversations	Paper II
Case E	Replacement of an HIS in the intensive care units of the GTH	Implementation project	16 interviews (approx. 13 hours), documents, informal conversations, observations	Paper V, Paper VI, Paper VIII
Case F-L	Minor changes to the EMR of the GTH	Affected activity	14 interviews (approx. 14 hours, two per case), documents	Paper VII
Case M	Implementation of an HIS in the normal care units of the GTH	Implementation project	19 interviews (approx. 9 hours), documents, informal conversations	Paper VIII
Case N-S	Organizational HIS usage in German (2) and US hospitals (4)	Health service delivery (activity)	65 interviews, observations	Paper III
Case T	Co-evolution of business and IT in the GTH spanning six years	Organization	Documents (500 files)	Paper IX

3.3.3 Case Selection

Case studies can follow different research designs. The basic types of case study designs differ according to the number of units that are analyzed: single-case design and multiple-case designs (Yin 2009).

According to Yin (2009), there are several rationales for single-case designs. The five major reasons are that the case either meets the conditions for testing a well-formulated theory, the case represents an extreme or a unique unit, the case is representative or typical of a given set of units, the case is revelatory in nature, or the case can be studied at two or more different points in time. Paper V, Paper VI, Paper VIII⁴ use a single-case research design for the

⁴ A previous version of this paper presented at the Internationale Tagung Wirtschaftsinformatik (2017) entitled as “What Teams Need to Be Clear About – an Activity Theoretical Perspective on Shared Understanding” employed a single case design. In the revised version included here, two cases are analyzed

following reasons. First, each case offered a rare opportunity to observe and analyze an HIS implementation project in-depth (revelatory cases). Second, the research site allows for studying the cases at multiple points in time (longitudinal cases). Third, the cases represent an instance of typical HIS implementation projects in German hospitals as goals, setting, and approaches are typical (see e.g., Hübner et al. 2012).

The rationale for including multiple cases in a case study design is to increase the robustness of the findings. Following a replication logic like in experimental designs, multiple-case designs include either cases that are expected to predict comparable results (literal replication) or cases that are expected to predict contrasting results for anticipatable reasons (theoretical replication) (Eisenhardt 1989; Yin 2009). This replication logic must be distinguished from the sampling logic commonly used in surveys. In a sample study, the researcher selects a sample from a broad population to answer a previously defined research question about this population (Maxwell 2013). The resulting data from the sample surveyed is assumed to be a representative sample of the population. In case studies, in contrast, cases are chosen for theoretical, not statistical, reasons (Eisenhardt 1989). They do not strive for representativeness, but typically select the cases in terms of the goals of the study and existing theory and research (purposeful selection) (Maxwell 2013).

Purposeful selection of cases for multiple-case designs may follow one or more of five major goals, which are similar to the rationales for single-case designs (Maxwell 2013). First, a goal may be to achieve typicality of the settings, individuals, or activities selected and to achieve unit homogeneity (Gerring 2008). Second, case selection may aim to capture the range of variation in a subset of units (extreme case heterogeneity), in which the mechanisms of interest are observable (Eisenhardt 1989). While the first goal primarily applies to a literal replication strategy, the second goal is rather important for studies following a theoretical replication strategy. Third, case selection could ensure that cases are included that are critical for either testing the theories that guided the study or those that have been subsequently developed. Fourth, case selection could facilitate explicit comparison of differences between the cases. Finally, case selection may also be driven by the quality and quantity of information that is available or could be easily collected. Table 9 depicts the primary criteria that drove case-selection for the papers included in this dissertation. Since all papers included in this dissertation, to some extent, make use of cross-case comparison, this criterion is not included in Table 9.

Table 9: Primary case-selection criteria for multiple-case designs

	Paper II	Paper III	Paper VII	Paper VIII
Typicality			Minor implementation projects related to the EMR	Implementation of patient data management systems
Heterogeneity	Maximum variance concerning the outcome (efficient use)	Contrasting cases, multiple sites (HIS implementation status, hospital type, environment)		
Criticality			Thorough consideration of the affected activity systems is critical	Shared understanding of the affected activities is critical
Comparability	Focus on differences in occurring misalignment		Focus on differences in consideration of the activity systems	
Accessibility	Single site with privileged data access (the same teaching hospital)	Opportunistic case selection (access and availability)	Single site with privileged data access (the same teaching hospital)	Single site with privileged data access (the same teaching hospital)

3.3.4 The Role of Theory

As outlined in Section 3.2.2, theories provide a model of why the world is like it is, how and why things happen (Strauss 1995). In short, theories are explanations. According to Eisenhardt (1989), there are three distinct uses of such explanations in case study research. Theories are used as an initial guide to design and data collection, as part of an iterative process of data collection and analysis, and as a final product of the research (Walsham 1995). Thus, theories are both an important input to and output of case study research. Each of these uses are briefly discussed below.

First, theory is an output of case study research. This view is well aligned with the typical research goals associated with case studies. Besides providing description, theory testing and theory generation are the two primary goals of case study research (Eisenhardt 1989; Maxwell 2013; Yin 2009). Case studies thus typically either test how good theoretical lenses explain contemporary phenomena as they unfold in practice or develop these. Consequently, refined theories (e.g., adapted boundary conditions, additional relevant dimensions, new relationships) or novel theories are critical outcomes of case study research (Eisenhardt 1989; Yin 2009). In this regard, a common concern about case studies is that the theoretical conclusions drawn provide little basis for generalization (Yin 2009). Though case studies do not aim to provide statistical generalization to populations by enumerating frequencies, case studies can generalize to theoretical propositions derived from extant and thus offer valuable

contributions (Lee and Baskerville 2003; Yin 2009). For empirical descriptions in a case study to be generalizable to a valid theory, methods that ensure the quality of the descriptions like triangulation of methods and data as applied in the papers of this dissertation are prescribed (Yin 2009). However, the generalizability of the resulting theory beyond these cases is comparable with sampling-based qualitative studies: “Generalizing beyond the given field setting in case research corresponds to generalizing beyond the given population in statistical research. Sample points may be generalized to sample estimates of population characteristics, but certainly have no generalizability beyond the given population.” (Lee and Baskerville 2003, p. 226)

Each of the case studies included in this dissertation either tests or develops theoretical perspectives. Thus, each paper contributes refined or novel theories in the form of concepts, conceptual frameworks, propositions or mid-range theories. These theoretical statements are generalizable within the case settings (Lee and Baskerville 2003) and may serve as inputs for statistical studies that may test the theoretical statements. The theoretical findings of the papers are presented in detail in Section 4 and their contributions for practice and research are summarized in Section 5.

Second, theories are used as a guide to design and data collection. In positivist research, theories enable the scholar to formulate the research question in terms of observable or measurable data and to specify the theoretical terms by means of the research operations used to measure these (Maxwell 2013). In contrast, theory enables interpretivists to create an “initial theoretical framework, which takes account of previous knowledge, and which creates a sensible theoretical basis to inform the topics and approach of the early empirical work” (Walsham 1995).

Third, theory not only guides data collection initially, but is used as a part of an iterative process of data collection and analysis (Walsham 1995). Independent of the philosophical stance, however, case studies require researchers to begin constructing some preliminary theoretical assumptions related to the topic of study (Maxwell 2013; Yin 2009). This distinguishes the case study methods from related methods such as ethnography and grounded theory.

Paper I and Paper II adopt a positivist paradigm. Consequently, theory was used to focus case study design, data collection and analysis on key variables that can be directly observed and verified. By means of operational definitions derived from theory, the types and content of data to be collected could be specified prior to data collection. Moreover, data analysis started once these data have been collected (Maxwell 2013). For instance, Paper II draws on prior theories on alignment and assumes that effective use of HIS (1) is contingent on the absence of misalignments and (2) can be objectively measured by counting documents that are available in the paper-based record and the HIS.

In contrast, Paper V, Paper VII, and Paper VIII follow the interpretivist paradigm. Here, theoretical statements were not only tested against the data, they were developed during and after the study (*a posteriori*) (Maxwell 2013). Instead of predetermining data collection, theory served as an input to an “iterative process of data collection and analysis, with initial theories being expanded, revised, or abandoned altogether” (Walsham 1995, p. 76). Using theory this way, however, requires researchers to be explicit about their assumptions about what is going on with the studied phenomenon (Miles and Huberman 1994), even though

they are open to change as they interact with the data. These assumptions reflect a researchers' 'theoretical sensitivity' (Strauss 1995) and provide the 'conceptual context' of the study (Maxwell 2013). Theoretical sensitivity refers to "the attribute of having insight, the ability to give meaning to data, the capacity to understand, and capability to separate the pertinent from that which isn't" (Strauss and Corbin 1998, p. 42).

Amongst others, theoretical sensitivity helps to identify and analytically resolve the elements of the structure that are causally relevant. Paper V, Paper VI, Paper VII, and Paper VIII employ theory in this way. Initial assumptions enabled the identification of constituent components such as actors, rules, and other instruments as well as variations, connections, and interdependencies between those components. These, in turn, were found to be related to observable misalignments in the empirical domain. Subsequently, theoretical perspectives that offer coherent explanations about the structures that produced these effects could have been developed and continually refined.

3.3.5 Data Collection

A major strength of the case study approach is that it allows data from various sources to be combined (Eisenhardt 1989). This reduces the risk that conclusions only reflect the biases of a specific method and facilitates the development of a thorough understanding of the issues investigated (Maxwell 2013). Beyond strengthening the conclusions, using various sources can also broaden the range of aspects of the phenomena covered by the data (*ibid.*). Typical sources of data include interviews, documents, observations, and artefacts (Cavaye 1996; Eisenhardt 1989; Yin 2009), which should be selected based on conceptual deliberations and accessibility (Maxwell 2013).

The case studies included in this dissertation use data from interviews, observations, and documents. Only Paper IX solely relies on interview data. However, the paper is conceptual in nature and the empirical data is only used to illustrate the theoretical deliberations. Since many and diverse types of documents were analyzed, the chance of selectivity and reporting bias is low.

Table 10 provides an overview of the papers' overall objectives, the sources of data collected for the papers and the insights the data sources provided. By combining and contrasting immediate results from different data sources, findings across data sets are corroborated and broadened. Moreover, the impact of potential source- or method-related biases is reduced. The main strengths, principles of data collection and measures taken to safeguard reliability are briefly described for each source below. Further validity and reliability checks that have been applied are explained in the data analysis section (see Section 3.3.6).

Table 10: Data sources employed in the papers included in this dissertation

Source	Objectives	Immediate result	Used
Documents (project documents, minutes, requirements, manuals, etc.)	Augmenting understanding of the context of the phenomenon (background material) Contextualize data collected in interviews and observations Identification of interviewees and further topics of concern (input for the interview guideline) Tracking change and development	Description of the phenomenon based on what is written ('social facts')	Paper II, Paper V, Paper VI, Paper VII, Paper VIII, and Paper IX
Interviews (medical, administrative and IT staff)	Understanding the interviewees' perspectives on the phenomenon Gathering the interviewees' knowledge about contextual factors Gaining descriptions of actions and events (particularly events that took place in the past)	Description of the phenomenon based on interviewees' statements	Paper I, Paper II, Paper III, Paper V, Paper VI, Paper VII, and Paper VIII
Observations (HIS usage in practice)	Learning about people's behavior and the context in which it occurs Contextualize data collected in interviews Understanding perspectives that are not stated in the interviews	Description of the phenomenon based on what was observed	Paper I, Paper II, Paper III, Paper V, Paper VI, and Paper VIII

3.3.5.1 Interviews

Interviews enable researchers to illuminate events from the perspectives of actors (Miles and Huberman 1994). They can express perceptions, feelings, and opinions of organizational actors about the events that surface in the empirical domain (Maxwell 2013). The interviewee can describe what he or she perceives and, as the interviewer occasionally summarizes or reflects on what he or she hears, may discover new relationships and patterns (Miles and Huberman 1994). According to the degree to which they are structured, several types of interviews can be distinguished (Patton 1990): informal, conversational interviews, semi-structured interviews, and open-ended interviews. Like in many other case studies (Yin 2009), the primary data source employed in the studies included in this dissertation are semi-structured interviews. In addition to including semi-structured interviews, Paper III, Paper V, Paper, VII, and Paper VIII also analyze informal, casual conversations.

The semi-structured interviews were supported by a predesigned guideline that contained a list of questions and general topics that the interviewers want to explore during the interviews (Miles and Huberman 1994). The questions included in the guideline serve to keep the interviewer focused on what information is sought and why (Yin 2009). The guidelines also ensure comparability of data across individuals, settings, and researchers, which allows the

researcher to focus on the phenomena being studied (Maxwell 2013), which Miles and Huberman (1994) call ‘local causality’.

Such guidelines make the interviewing process more systematic and comprehensive but give the interviewer high degrees of freedom to probe and explore within these guidelines. Using such guidelines, the semi-structured interviews conducted in the papers discussed here aim to balance generalizability and comparability with internal validity and contextual understanding (Maxwell 2013). In line with the interpretive nature of most studies included in this research, the interview guidelines were revised as required (Maxwell 2013). Fields of inquiry and related questions were added as emergent insights drew attention to hitherto uncovered areas of importance. Likewise, questions that proved unproductive in reaching the goals of the research were excluded.

In the studies that used multiple informants per case (Paper III, Paper V, Paper VI, Paper VII, and Paper VIII), the selection of interviewees followed the key informant approach (Kumar et al. 1993). Though the informants were purposefully selected and augmenting the data with other sources revealed no validity issues, there is no guarantee that the perspectives of the informants were typical or that no social desirability effects were at play (Maxwell 2013). To mitigate the chance of informant biases, multiple and highly knowledgeable informants who view the phenomena under investigation from different perspectives were selected whenever possible (Eisenhardt and Graebner 2007).

In single-case studies concerned with organizational issues (Paper V, and Paper VI), semi-structured interviews were conducted with at least seven interviewees. In multiple-case studies, two to eight informants were selected (Paper III, Paper VII, and Paper VIII). Following the advice of Eisenhardt and Graebner (2007), these informants included organizational actors from different hierarchical levels, functional areas, groups, as well as actors from other relevant organizations (e.g., external project managers). Moreover, additional casual conversations and observations of actors indicate that the risk of systematic information bias is rather low.

3.3.5.2 Observations

Observations are aimed at gathering an in-depth understanding of what is going on in a particular setting. They provide an immediate way of learning about people’s behavior and the social and historical context in which it occurs (Maxwell 2013). During observations, attention can be focused both on events and on what the persons involved say about these. Overall, they provide “a rich experiential context which causes [the researcher] to become aware of incongruous or unexplained facts, makes [the researcher] sensitive to their possible implications and connections with other observed facts, and thus [they push the researcher] continually to revise and adapt his theoretical orientation and specific problems in the direction of greater relevance to the phenomena under study.” (Becker and Geer 1957, p. 32)

Though some people believe that reactivity is a serious validity threat to observational data, an observer is found to influence participants’ behavior much less than the setting does (Maxwell 2013). Nonetheless, as observations are filtered through the researcher’s interpretive frames, scholars in the field recommend that researchers install reliability controls by relying on explicit theoretical frameworks and by paying thorough attention to details (ibid.). This suggestion has been implemented in this research (see Section 3.3.4).

Taking advantages of these strengths, observations were used in many papers to verify and broaden the data gathered through interviews. The events, behavior and contextual features were recorded as field notes in a research diary, either during or immediately after the observations (Yin 2009). In the papers included in this study, these data augment the data collected from other sources. For instance, data was used to contextualize data collected in interviews and to better understand perspectives and relationships that were not mentioned during the interviews or only at the outset. Among others, observations allowed to notice and/or enhance understanding about implicit rules and modes of task distribution.

3.3.5.3 Documents

As laid out in Table 10, documents provide background and context, complementary data, a means of tracking change and development and verification of findings from other data sources, and also point to additional questions to be asked (Bowen 2009). Documents are already available, are unaffected by the research process, stable and are relatively exact as they typically contain exact names, references, and details (Yin 2009). However, documentation is produced for some purpose other than research and thus may not provide sufficiently detailed information concerning the research interests (Bowen 2009). Moreover, access to documents may be deliberately blocked other otherwise limited (Yin 2009).

In contrast to interviews and observations, gathering data from documents requires data selection rather than data collection. To avoid selectivity bias and incomplete collection of documents in the papers included in this dissertation, all available documents were included (Bowen 2009). As to that, all informants were asked for available documents (e.g., minutes, requirements, manuals and all documents that where referred by interviewees or discovered during the observations were included in the analysis.

Like observations, documents were compared with data collected in interviews to check the statements of informants and thus increase validity of the findings. Documents also augmented data from other sources to increase contextual understanding (Yin 2009). Moreover, within Paper V, VII, and VIII, documents were used to trace developments (e.g., project objectives as documented in project scope documents vs. actual project outcomes). In Paper II documents also serve as objective measure of the outcome variable and the empirical evidence in Paper IX is solely dependent on documents.

3.3.6 Data Analysis

The process and methods of data analysis employed in the papers included in this dissertation differed depending on the philosophical stance adopted. In accordance with the principles of interpretative research, data collection, data analysis, and theory development occurred in a mode of continuous interplay in Paper V, Paper VII, Paper VIII, and Paper IX. Paper III and Paper IV also followed an interpretivist paradigm. However, both paper analyze existing case study data, so only data analysis and theory development were conducted iteratively.

Paper I and Paper II adopted a positivistic paradigm. Here, data analysis focused not on theory development but on hypotheses testing and did not begin before data collection was completed. While Paper I applies an explorative approach, Paper II draws on a formalized approach of analyzing qualitative data based on Boolean algebra: the qualitative comparative analysis (QCA). Coding in each approach was supported by the qualitative data analysis

computer software package NVivo (QSR International Pty Ltd 2012). More details to the data analysis approaches are presented below.

3.3.6.1 Iterative Interpretative Approach

In Paper III, Paper V, Paper VI, Paper VII, and Paper VIII an interpretative perspective to make sense of the data was adopted (Walsham 1995; Walsham 2006). Here the analysis was not aimed to test hypothesis or the explanatory power of given assumptions, but rather to develop meaningful interpretations of the relevant parts of the social structures, which have the powers and liabilities to act and cause the observed events (Sayer 2010, p. 92).

Before collecting (Paper V, Paper VII, Paper VIII, and Paper IX) and analyzing the data (Paper III and Paper IV), the authors reflected on recent empirical findings and developed their theoretical sensitivity (Strauss 1995). The following analysis was structured in two cycles. Both cycles iteratively combined theoretical consideration, assumption development, data coding, and alignment of empirical patterns identified in the data with underlying theory (Walsham 1995).

The first cycle was conducted parallel to the data collection. The primary aim of this cycle was to condense the material, to gain a full picture of the events observed, and to develop a fundamental grasp of potentially causal relevant social structures the cases are embedded in. To this end, an open coding technique was applied (Miles and Huberman 1994). While further data were collected, the material was repeatedly reviewed, initial codes were integrated into higher-level codes and narrative case descriptions created. According to the interpretivist paradigm, these rich descriptions of the cases provide the foundation for developing generalizations to concepts and theories (Walsham 1995).

During the second cycle, the condensed data was further analyzed by means of pattern coding. First, the higher level-categories found in cycle one were further condensed into smaller analytical units and labelled. Looking at the different data collected in each case from different perspectives, unfreezing and reconfiguring the analytical units, and cross-checking emerging themes, relationships as well as potential causally relevant structures were assigned to the themes. In Papers VII and VIII, this further laid the groundwork for cross-case analysis. To this end, the themes were compared to identify similarities and differences across the cases (Miles and Huberman 1994; Yin 2009). Overall, this pattern-matching technique guided identification and comparison of emerging empirical themes with those recognized in theory. The result of this step was one or multiple concept-driven matrices at various levels of detail. Examples for such conceptually clustered matrices are, for instance, found in Paper VIII (Table 2 and Table 3).

Where findings or their interpretations differed between the researchers, the cases were discussed until agreement on the contents of the concept matrix was reached (Miles and Huberman 1994). This matrix then enabled the researchers to assess if the interpretation of the empirical events as reported in the rich case descriptions and the theoretical deliberation coincided. Ultimately, this technique helped developing theoretical statements that provide coherent explanations which structures and mechanisms are at work and thus how and why the observed events occurred (Yin 2009).

However, it must be admitted that case studies have difficulties to yield reliable statements about the magnitude of causal effects and the uncertainty of the point of estimate across a

population (Gerring 2008). Nonetheless, case studies can plausibly yield causal mechanisms in the form of connections between structures and events in a plausible fashion, particularly if theoretical perspectives support such arguments (ibid.). Ideally, analysis enables one to ‘see’ how structures interact and produce events by revealing plausible connections.

To improve the internal validity of such explanations, emerging patterns were thus checked not only against initial and emerging theoretical assumptions, but also against rival explanations (Miles and Huberman 1994; Yin 2009). Moreover, pattern matching-technique was also used to check if the inferences concerning the structures and mechanisms at work could also explain the absence of events observed in other cases (Yin 2009). Concerning multiple-case studies, moreover, it was checked if within-case assumptions and cross-case assumptions converge by continually going back-and-forth from within-case to cross-case evidence (Gerring 2008). If necessary, rival explanations were included and initial assumptions were revised (Eisenhardt 1989).

In addition to assuring internal validity, data analysis also must assure external validity, i.e. whether inferences are generalizable beyond the immediate case study. Critics typically state that case studies, particularly single-case studies, offer a poor basis for generalizing (Yin 2009). However, as noted in Section 3.3.4, a distinction between what the research is generalizing from and what the researcher is generalizing to has to be made (Lee and Baskerville 2003). For empirical descriptions in a case study to be generalizable to a valid theory, methods that ensure the quality of the descriptions like triangulation of methods and data are prescribed (Yin 2009). Moreover, adopting a replication logic by conducting many single and multiple-case studies may increase confidence in the findings, though they are still only generalizable within the settings of the cases. The set of papers included in this paper follow this advice to increase external reliability of the findings and triangulate empirical evidence and broaden the scope by including an array of cases within typical settings.

To capture greater richness and to mitigate the potential of coding bias, data analysis was always conducted as a team effort (Eisenhardt 1989; Yin 2009). Following the guidelines of Miles and Huberman (1994), at least two researchers analyzed the data. Moreover, the resulting codes, matrices, and inferences were constantly compared, analyzed, and discussed. When inconsistencies or gaps arose, data was reviewed and interviewees were re-questioned until inconsistencies were resolved (Yin 2009).

3.3.6.2 Explorative Linear Approach

The data analysis methods applied in Paper I and Paper III resemble the coding strategy of the second cycle of data collection described above. The methods aimed at discovering themes that provide support for the hypotheses or assumptions derived from prior literature. Similar techniques were applied during the iterative, interpretative approach. The procedure was organized as briefly described below.

First, data was condensed and categorized by assigning descriptive codes and developing case narratives. Second, the descriptive codes were analyzed and assigned to a set of preliminary codes based on the theoretical framework (conceptual codes) (Miles and Huberman 1994). Third, data that were not covered by conceptual codes were further analyzed. If necessary, the coding structure was extended. An example of a coding scheme can be found in Paper I (Table 3, first and second level of the scheme). Fourth, conceptually coded data was analyzed

using an iterative approach building on the pattern-matching technique (Yin, 2009) and the tactics for drawing and verifying conclusions by Miles & Huberman (1994). By means of analyzing and comparing codes and patterns, conceptual matrices that contain condensed data on individuals or cases, concepts and relationships between the concepts as well as their significance were derived. A comprehensive version of a conceptual matrix is presented in Paper I (Table 3). Condensed versions are found in Paper I (Table 4) and Paper III (Table 4). Fifth, based on the conceptual matrices, the initial hypotheses or assumptions were evaluated and revised as necessary (Eisenhardt, 1989). Moreover, measures taken to safeguard validity and reliability of data as reported in 3.3.6.1 were applied.

3.3.6.3 Formal Comparative Approach

Paper II employs a set-theoretic method to conduct cross-case analysis, the so called qualitative comparative analysis (QCA). This method is drawing increasing attention of IS and management researchers to their capability to investigate complex dynamics such as the role of IT within socio-technical systems (El Sawy et al. 2010). QCA was initially developed by Ragin (1987, 2000) and combines the strengths of both case-oriented qualitative methods and variable-oriented quantitative methods (Rihoux and Ragin 2009). Moreover, QCA can be applied for studying small, medium, or a substantial number of cases at various levels. Although QCA is still in its infancy in IS research, it is already widely used in sociology, political science, and more recently management studies (e.g., Brown and Boswell 1995; Fiss 2011; Greckhamer et al. 2008; Haworth-Hoepfner 2000).

QCA aims to support the development or test of configurational theories by formally identifying patterns and combinations of elements (configurations) that are related to certain outcomes (see e.g., Rihoux and Ragin 2009). Configuration theories “view phenomena as clusters of interconnected elements that must be simultaneously understood as a holistic integrated pattern (versus individual elements separately)” (El Sawy et al. 2010, p. 832). Thus, “the general goal of a QCA is to support the researcher in the attempt to arrive at a meaningful interpretation of the (causal) patterns displayed by the cases under examination” (Wagemann and Schneider 2010, p. 380). Configurations as specific combinations of conditions that generate an outcome of interest reflect these patterns. Conditions are causal variables that reflect, e.g., characteristic elements of a case. Key aspects of configurational theories are summarized in Table 11.

Table 11: Key aspects of configurational approaches (El Sawy et al. 2010)

Aspect	Explanation
Holistic and systemic perspective	An outcome of interest is assumed to be determined by holistic patterns and combination of causal elements (so called conditions). Additivity of individual variables is not assumed.
Equifinality	Different causal combination may determine the outcome of interest.
Limited diversity	Not all possible combinations of conditions must be relevant. The theoretical and empirical reality may result in a limited diversity of configurations in practice. Theoretical and contextual understanding makes the inference of causality manageable.
Research propositions as causal recipes	Configuration theories express hypotheses as causal combinations that postulate the relevant elements that in combination produce particular outcomes within a given context, including statements about the relative importance of specific conditions (core vs. peripheral conditions)
Discontinuity and nonlinearity	The combinations determining the presence of an outcome can be different than those leading to the absence of an outcome (termed causal asymmetry).

As said, QCA is understood as a methodological “third way” between qualitative (case-oriented) and quantitative (variable-oriented) methods (Wagemann and Schneider 2010). On the one hand, QCA is case-oriented in the sense that it deals with a limited number of cases. Thus, QCA requires in-depth engagement with qualitative data during within-case analysis. However, QCA also requires researchers to choose and define variables (conditions and outcomes) for the analysis and offers formalized, systematic, and ‘numbers-based’ techniques for comparing the variables and combination of variables across cases.

The main concepts that underlie QCA are the notions of set-relations (necessity and sufficiency), consistency and coverage as parameters of fit; the truth table as a central tool for data analysis; the process of minimization; and the different solution terms offered by QCA (Rihoux and Ragin 2009). These concepts are briefly explained below. For a more detailed introduction to QCA please see Wagemann and Schneider (2010) (introductory article) and Rihoux and Ragin (2009).

QCA looks at conditions and the combination of conditions that are sufficient and/or necessary for the outcome of interest. To perform such analysis, first conditions that are theoretically grounded need to be identified. Then cases need to be evaluated and membership scores in the conditions and in the outcome need to be assigned. Depending on the type of QCA applied, the set membership is either dichotomous (1 or 0, crisp-set QCA) or fuzzy (the scores range from 0 to 1, fuzzy-set QCA). To analyze relevant set-relations that are conditions or combination of conditions which are necessary or sufficient for the outcome, QCA draws on Boolean algebra. Though a single condition may play a causal role, it must per se neither be necessary or sufficient (Wagemann and Schneider 2010). Such conditions are called “INUS conditions” (insufficient but necessary part of a condition which is itself unnecessary but sufficient for the result) (ibid.). These set-relations reflect different paths to an outcome,

which contrasts the unifinal perspective of many statistical techniques such as linear regression models (Wagemann and Schneider 2010).

Truth tables are at the core of any type of QCA as they enable the identification of sufficient and necessary conditions and/or combination of conditions (Schneider and Wagemann 2007). The potentially causal relevant conditions and the outcome form the columns of the truth table, whereas the rows reflect the configurations (empirically observed and logically possible). Thus, the truth table is a powerful heuristic tool that provides indication of which cases “are analytically identical and how much and what kind of limited diversity is in the data” (Schneider and Wagemann 2010, p. 413). Moreover, the truth table is the input to logical minimization based on Boolean algebra that lead to the QCA solution terms.

Boolean minimization serves to identify general combinations of conditions sufficient for the outcome that remain logically true (Rihoux and Ragin 2009). To that end, all logically possible set-relations (i.e., the rows of the truth table) are examined to see whether they lead to the outcome. Then, the minimization attempts to reduce these so-called primitive expressions to simpler combinations of conditions that are logically equivalent (ibid.).

To further reduce the complexity of these QCA solution terms, the use of logical reminders is recommended (Rihoux and Ragin 2009). Logical reminders are theory-driven assumptions about how unobserved conditions may be causally related to the outcome of interest.

Depending on the approach to logical reminders, the minimization process yields three different solution terms: complex, intermediate, and parsimonious solutions. A complex solution results if no logical reminders are included (Rihoux and Ragin 2009). The parsimonious solution reflects the smallest number of INUS conditions. The decisions concerning the outcome of logical reminder is made by the algorithm without any theoretical or empirical reasoning concerning its plausibility. The intermediate solution includes only logical reminders that are consistent with theoretical or empirical knowledge. Selecting plausible logical reminders thus requires substantive empirical or theoretical knowledge of how a condition contribute to an outcome.

QCA can be viewed as a research approach or as a data analysis technique (Ragin 1987). Although the value of QCA as a research approach for developing meaningful explanations of complex phenomena has been acknowledged (Ragin 1994, p. 76), applying QCA as a comprehensive research approach requires a large set of 15 to 50 cases (Wagemann and Schneider 2010). As the number of cases analyzed in Paper II is below this threshold, QCA was primarily used as a data analysis technique. QCA was selected because it enables the researcher to deal with causal complexity and does not require uniformity of causal effects and unit homogeneity (Berg-Schlusser et al. 2009). Moreover, QCA provides a formal set of tools to conduct cross-case analysis. For details on the approach please see Paper I.

3.4 Summary

Within this dissertation, multiple paradigms and methods were triangulated to answer the research questions. The methods employed encompass a structured literature review as well as qualitative and quantitative research methods. Moreover, the papers included in this dissertation followed either a positivist or interpretive stance to respond to the research questions. The following section presents the main research results.

4 MAIN RESEARCH RESULTS

The cumulative dissertation includes nine papers and this introductory paper. The focus of the papers ranges from the identification of operational misalignments between HIS and structures and processes of healthcare delivery, the analysis of business-IT alignment processes concentrating on the role of cross-domain interconnectedness and the ability to adapt business and IT (particularly shared understanding) in HIS implementation and change and finally the explanation of change processes aimed to improve function integration of HIS and medical practices. By triangulating methods and theories, each paper responds to one or more of the detailed research questions of this dissertation as outlined in Section 2.4. Table 12 provides a first overview of the focus of each paper and summarizes the main results of the papers according to the detailed research questions. The following section presents the main research results in greater detail.

Table 12: *The main results of the papers organized according to the detailed research questions (emphasis of the papers and their results are highlighted in grey)*

	RQ1: Operational Misalignments	RQ2: Cross-domain Interconnectedness	RQ3: Ability to adapt business & IT	RQ4: OBITA process theory
Paper I	Misalignments between HIS and personal motives, organizational structures and processes (e.g., roles, workflows) inhibit integration of HIS in medical activities			Process theory must acknowledge continuous reciprocal effects across personal dispositions, environmental dispositions and behavior
Paper II	Misalignments in five domains (occurring in different configurations) impede effective usage of HIS.			
Paper III	Classification of three types of contradictions (i.e., misalignments) within activity systems that limit enactment of the possibilities HIS offers (i.e., shared and collective affordances)			OBITA processes need to focus on the reciprocal interplay between interrelated HIS affordances, enactment of the possibilities HIS offer and features of the activity systems the HIS is embedded in

	RQ1: Operational Misalignments	RQ2: Cross-domain Interconnectedness	RQ3: Ability to adapt business & IT	RQ4: OBITA process theory
Paper IV		Structural, relational, and cognitive social capital constitute cross-domain interconnectedness; relational and cognitive social capital mitigate the challenges that come with structurally decoupled organizations	Cross-functional cooperation that is characterized by strong cognitive linkages between medical and IT professionals positively influences the ability to adapt business & IT	
Paper V	Misalignments among divergent objectives of occupational groups and the division of labor put HIS implementation at risk	Reciprocal relationship between social capital and OBITA processes: social capital facilitates the development of shared understanding, while the outcomes of OBITA processes impact social capital	The capacity of actors to integrate their idiosyncratic knowledge and to develop an integrated account of how HIS will affect and is affected by medical reality is key for OBITA processes and outcomes	Alignment between HIS and medical structures and processes is shaped in iterative processes of negotiating the role of HIS within medical activities
Paper VI		When they are legitimate 'participants' in their activities, artefacts can create cognitive linkages between IT and medical professionals	The ability to adapt HIS and medical structures and processes is enhanced by artefacts that bridge IT and medical activity systems, facilitate translation of knowledge about these and enable recognition of contradictions	

	RQ1: Operational Misalignments	RQ2: Cross-domain Interconnectedness	RQ3: Ability to adapt business & IT	RQ4: OBITA process theory
Paper VII	Misalignments tackled by OBITA processes can be traced back to contradictions related to HIS-mediated subject-object relationships or contradictions related to rules and the division of labor		The ability to adapt HIS and medical structures efficiently requires reflection of the contested, mediated, situated, and provisional nature of medical activity and the potential for contradictions that arise	Theories that explain OBITA processes and their outcomes must consider the individual level (i.e., users) and the collective level (i.e., context)
Paper VIII	Misalignments tackled by HIS implementation can be traced back to contradictions related to HIS-mediated subject-object relationships or contradictions related to rules		Shared understanding about the three major HIS-mediated relationships that constitute medical activities is needed (subject-community-object; division-of-labor-object; rules-object) to resolve existing misalignments without creating new ones	OBITA processes risk creating new misalignments that need to be resolved in the aftermath; effective resolution of misalignments thus require iterative adaptations to HIS and other elements of the activity systems the HIS is embedded in
Paper IX	Diverse organizational structures and processes of IT leads to overlapping functionality of HIS	Interconnectedness between IT and medical units can be conceptualized as linkages between both activity systems	In-depth knowledge of both activity systems and their interrelation enable managers to chart the course that will shape iterative transformations over time	OBITA processes can be viewed as continuous and reciprocal adaptations to elements of the activity systems of business and IT. Contradictions within and between the systems trigger OBITA processes.

4.1 Paper I: Salient Beliefs about and Use of EMRs ⁵

As discussed above, the knowledge concerning the nature of misalignments between HIS and organizational structures and processes that relate to contextual specifics of healthcare delivery in hospitals is limited (Abouzahra et al. 2015) and most research does not apply to the German healthcare system (Cresswell and Sheikh 2013). Paper I sets out to enhance the knowledge in this area by identifying dominant operational misalignments between HIS and the structures and processes of healthcare delivery in German hospitals. More particularly, considering the unique characteristics of the use-context within German hospitals, this study focuses on physicians' beliefs about using electronic medical records (EMR) and how these beliefs enable or inhibit successful implementation of EMR systems.

To elicit the beliefs of physicians, interviews with managing and lower-level physicians were conducted in six German hospitals. The sample involves physicians with different experiences concerning EMR usage, hierarchical levels and medical disciplines. To gather additional information on their use-behavior and environmental conditions, EMR usage was also observed, as recommended by Yin (2009). Results of the empirical analysis reveal different behavioral, personal, and environmental beliefs. In line with the assumptions of social cognitive theory, the findings provide evidence that physicians' EMR usage behavior is shaped by a continuous reciprocal causation across personal dispositions, environmental dispositions and behavior (see Figure 6).

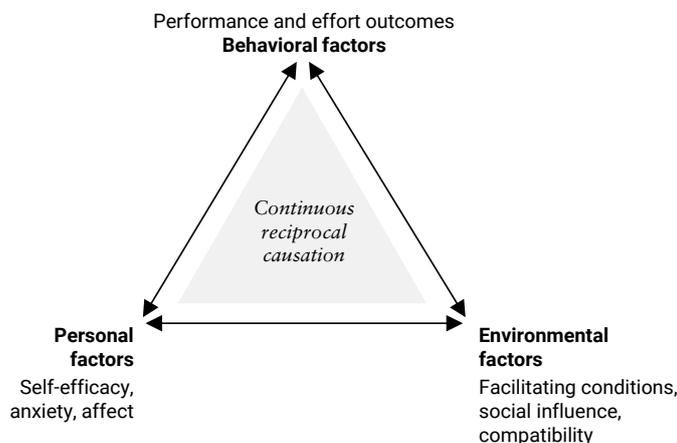


Figure 6: Beliefs and reciprocal causation as identified in Paper I

⁵ Weeger, A., and Gewald, H. 2015. "Acceptance and Use of Electronic Medical Records: An Exploratory Study of Hospital Physicians' Salient Beliefs About HIT Systems," *Health Systems* (4:1), pp. 64–81.

This paper is partly based on a previous manuscript: Weeger, A., and Gewald, H. 2013. "Examining Social and Cognitive Aspects Determining Physician's Adoption of Electronic Medical Records." *European Conference on Information Systems*. Utrecht.

Concerning dominant misalignments between HIS and the structures and processes of in-patient healthcare delivery, the empirical findings indicate that healthcare-specific characteristics like hospital structures, multiple and distinct hierarchies as well as the presence of a strong professional identity often contradict EMR usage and foster resistance to IT-related change. In line with the literature, it is shown that physicians' professional identity still binds them to altruistic objectives (see e.g. Sulmasy 1992). Therefore, patient-related outcomes such as quality of care and patient safety were found to play a vital role in forming physicians' beliefs. Here, Paper I reveals that EMRs are not well-aligned with existing workflows and routines and thus limit their freedom of action and increase the possibility that their work is interrupted, among others. Moreover, Paper I shows that, from physicians' point of view, the environment involving IT staff and hardware equipment must be adapted to facilitate replacing paper-based records with EMRs. Unsurprisingly, in many hospitals paper-based records and HIS are used in parallel, which, in turn, was found to heighten the tensions mentioned above.

4.2 Paper II: Misfits between a Hospital and its HIS ⁶

Paper II builds on the findings of Paper I and analyzes how misfits (i.e., misalignments) between an HIS and the processes and structures of a hospital influences HIS usage-patterns and their outcomes (i.e., achievement of organizational goals). Since IS research was found to offer little insight into what effective usage involves and what its inhibitors are (Burton-Jones and Grange 2013), the investigation of usage behaviors and the identification of factors impeding effective HIS-usage addresses an important gap. Building on prior literature on effective use (Burton-Jones and Gallivan 2007; Burton-Jones and Grange 2013), task-technology fit (Goodhue and Thompson 1995), and organization-enterprise system fit (Strong and Volkoff 2010) and considering the specifics of the hospital context, an operational definition of effective usage of a specific HIS was provided and related to six domains of misalignments. Building on the findings of Paper I, the level of effective use was determined assessing the extent to which paper-based documentation was used in parallel to the HIS.

To test the assumptions and to find salient patterns of simultaneously occurring misalignments that may explain distinct levels of HIS-usage efficiency, a multiple-case study involving four wards of a single hospital was conducted. With the help of a medical consultant of the hospital, four wards that employ the same HIS and have comparable types of medical processes, but predict various levels of effective HIS-usage were selected. By means of interviews and observations, misfits in five out of six dimensions were observed. The misfits are listed in Table 13.

⁶ Weeger, A., Neff, A., Gewalt, H., and Haase, U. 2013. "Exploring Determinants of Effective Use: The Role of Misfits between a Hospital and Its Information System," *Multikonferenz Wirtschaftsinformatik*. Paderborn.

Table 13: *Observed misalignments between the HIS and organizational structures and processes at the wards*

Misalignments	Brief Description
Functionality	
Lack of data transfer support	Although patient data (e.g. the initial diagnosis) are stored in the system, data must be typed in manually for each request
No mobile access	Patient data such as results of examinations cannot be accessed when there is no workstation available locally (e.g. in patient rooms on the ward round)
Missing notification functions	The CWS lacks a 'general notification function' for newly arrived findings. Hence, physicians need to check for updates manually
Usability	
Usage difficulties	The users evaluate the interaction with the IS as not adequate for searching and extracting information.
Insufficient performance	The performance of the system is insufficient (e.g. time needed for opening records and searching for results e.g. due to slow response time)
Confusing representation	The representation of the data provided by the IS is confusing.
Role	
Access restrictions	Lack of access rights for specific tasks (e.g., surgery planning)
Control	
Lack of traceability	The CWS provides too little control regarding the traceability of access
Organizational Culture	
Authoritarian leadership	Medical directors and assistant medical are not using the system to assess information, they are asking their subordinates and use paper-based records

The misalignments observed largely confirm the findings of Paper I. Although all nine misalignments potentially present at the wards were found to impede HIS usage, cross-case analysis applying crisp-set QCA (Rihoux and De Meur 2009) revealed that a lack of data transfer support, lack of traceability and insufficient performance are critical when looking at efficient use of the HIS. Furthermore, configurational analysis indicates that different misalignment types vary in terms of their impact on the level of effective HIS use at the wards. The absence of critical misalignments between organizational requirements and the HIS are facilitating effective use, while the presence of control and usability misalignments is impeding effective use.

4.3 Paper III: Technology Affordances in Healthcare ⁷

In line with prior research in other contexts, Paper I and Paper II provide evidence that HIS are often poorly aligned with the needs and characteristics of prospected users and socio-organizational elements of the healthcare sector (Tan and Or 2015) and that healthcare professionals contextual realities are crucial to explaining HIS usage behavior (Mettler et al. 2017). In this regard, literature further indicates that insufficient consideration of the context was found to limit understanding about why systems that work well in one setting may fail in another, as, for instance, shown in Paper II (Fichman et al. 2011; Jones et al. 2014). Thus, the need for theory-driven research that explores the distinct roles HIS plays in healthcare considering its diverse organizational and social peculiarities is emphasized (Fichman et al. 2011; Strong et al. 2014). Paper III contributes to our knowledge in this field.

Accounting for characteristics of user, context and technology as elicited in Paper I and Paper II, recent research shows that affordances are a powerful concept for understanding and explaining behavior and technology use (Grgecic et al. 2015; Piccoli 2016) and IT-related organizational change processes (Strong et al. 2014). Building on these insights, Paper III conceptualizes technology affordances as emergent properties of the actor-environment system that determine what can be done with technology (Norman 1999). Augmenting technology affordance theory with AT, it is theorized that the activity system framing the interplay of material properties of technology, organizational actors' capabilities and goals, and socio-organizational properties determines the emergence and realization of HIS affordances. The conceptualization of these affordances draws on the work of Strong et al. (2014). Contradictions within the activity system that emerge from multiple points of view, traditions and interests accumulated in collective activities are assumed to limit realization of these affordances and thus jeopardize the expected outcomes of HIS implementation.

Building on these theoretical considerations and focusing on EMR, Paper III analyzes two distinct use-contexts within six hospitals in Germany and the US, the characteristics of the activity systems and HIS-affordance patterns. Among others, empirical evidence confirms the applicability of the classification of generic EMR-affordances as provided by Strong et al. (2014). More importantly, Paper III contributes to literature by showing that affordance realization relates to the characteristics of activity system components, their complementary nature, and dynamic interplay. Capturing these, Paper III provides a classification of HIS-misalignment types (i.e., contradictions) that inhibit the realization of the potential of HIS for goal-oriented behavior (i.e., affordance actualization). Type 1 contradictions were found to explain why EMR affordances are not shared by members of a group or an entire organization. Type 2 and type 3 contradictions offer explanation why affordances that emerge as a combination of distinct, but aligned affordances are not realized. It is assumed

⁷ Weeger, A., Gewald, H., and Gewald, C. 2017 "An Activity-Theoretical Extension of Technology Affordances in Healthcare." – submitted to the Thirty Eighth International Conference on Information Systems (ICIS), Seoul

This submission is based on a previous paper: Weeger, A., Gewald, H., and Gewald, C. "Is it that only money matters? A cross-national analysis of health information system usage." SIGHealth Workshop at ICIS 2016: Design, Innovation, and Impact of Healthcare IT, Dublin

that all three types need to be approached by OBITA processes to improve efficiency of HIS and to realize expected performance gains.

Table 14: *Types of contradictions found to influence EMR affordance actualization*

Contradiction Types	Brief Description
Type 1 contradictions	Concerned with the <i>subject-community-object relationship</i> and involves contradictions that emerge from different, evolving perspectives on the object of medical activities and the functional properties of the EMR (the EMR is emphasizing single perspectives on the object)
Type 2 contradictions	Focuses on the <i>subject-division-of-labor</i> relationship and is concerned with the potentials of EMR affordances to contrast the distribution of tasks, roles, responsibilities and status that evolved over time
Type 3 contradictions	Refers to <i>rule-related contradictions</i> within activity systems (a lack of explicit rules reinforces established practices and implicit rules that contradict the affordances of the EMR such as resolving boundaries between occupational communities)

The results of Paper III also indicate that the bundle of interrelated and interacting EMR affordances arise from the relation between functional properties of the EMR and the characteristics of the activity systems to which it is introduced. Extending prior research (Strong et al. 2014), Paper III reveals that not only affordance realization is dependent on the interplay of activity system components, but that the outcomes of affordance realization also affect these characteristics. Hereof, realizing or discarding affordances was found to either resolve or reinforce contradictions within activity systems and thus influence the emergence of follow-on affordances.

4.4 Paper IV: Social Capital between IT and Medical Units ⁸

Aimed to enhance our knowledge about how the misalignments identified in Paper I, Paper II, and Paper III can be avoided and/or resolved, Paper IV analyzes how OBITA processes in hospitals can be facilitated. Paper IV focuses on minor changes to HIS concerned with medical documentation in German hospitals. Drawing on prior research on social OBITA (Wagner et al. 2014; Wagner and Weitzel 2006), a theoretical model based on SCT is developed and empirically tested in German hospitals. It is argued that social capital, that is, cognitive, structural, and relational linkages between IT and medical professionals, impacts the degree to which business and IT units cooperate at the operational level. It is further hypothesized that cross-functional cooperation, in turn, drives functional integration of HIS and business processes and structures and, eventually, IT business value. To evaluate the

⁸ Weeger, A., Ohmayer, L., and Gewald, H. 2015. "Operational Alignment in Hospitals – the Role of Social Capital between IT and Medical Departments," *European Conference on Information Systems*. Münster.

model a quantitative study targeting physicians that are responsible for the enhancement of the HIS for medical documentation employed in their hospitals was conducted.

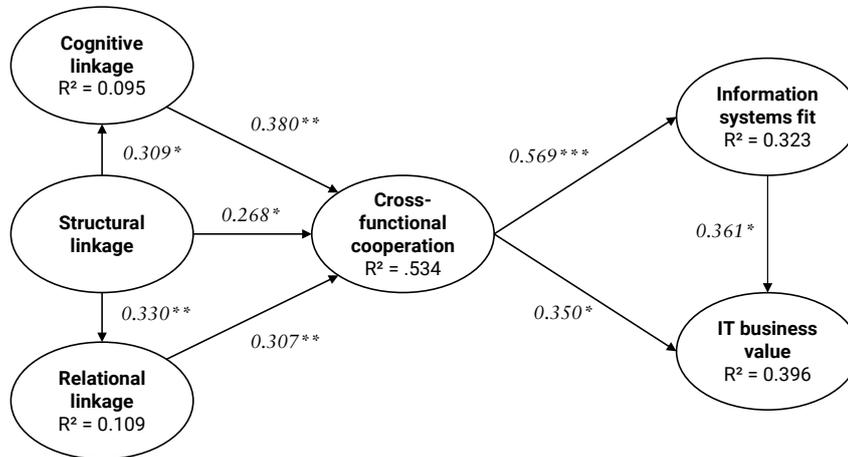


Figure 7: Research results of Paper IV

The empirical results (as depicted in Figure 7) provide convincing evidence that cross-functional cooperation between business and IT is facilitated by cognitive, structural, and relational social capital between these organizational entities. Of the three, the cognitive dimension has the strongest effect. Moreover, strong cross-functional cooperation in enhancing HIS is found to influence IT business value both directly and mediated through the degree to which HIS are integrated with structures and processes of the medical departments.

The empirical findings also show that parts of the effect of formal structural linkages are mediated by cognitive and relational dimensions. Thus, evidence is given that having the opportunity to interact does not per se positively impact cross-functional cooperation. Rather, IT and medical professionals need to develop mutual trust and need to effective in creating shared languages, representation, and perspectives. Considering the relationship between the structural and the relational dimensions, the empirical results provide evidence that regular meetings strengthens mutual trust and respect. This effect contradicts the findings of prior research (Karahanna and Preston 2013). Explanation for this finding may be found in specifics of the healthcare context, particularly the ‘decoupled’ nature of hospitals (Doege and Martini 2008), where organizational structures are considered to offer few opportunities for interaction between regular meetings between medical and IT professionals.

Considering IT business value, the empirical results reveal that value from IT is contingent on social relations and their structure. In line with prior literature, Paper IV thus posits the process of IT value creation as a mechanism of social construction (Avgerou 2001). Findings show that fruitful cross-functional cooperation between medical and IT professionals both directly and mediated through IS fit influences the value of HIS in hospitals. Overall, Paper IV indicates that social capital between business and IT unfolding in effective collaboration at the operational level enhances the integration of HIS and medical processes and structures and the generation of IT business value. Moreover, as cognitive social capital is found to have

the strongest effect on cross-functional cooperation, the importance of shared understanding of medical activities and the role of HIS for OBITA processes and outcomes is emphasized.

4.5 Paper V: Social Capital in HIS Implementation ⁹

As revealed in Paper IV, social capital is found to influence IT and medical professionals' ability to jointly align HIS and medical practices. By building on prior research showing *that* social capital positively impacts knowledge integration processes between business and IT (van den Hooff and de Winter 2011; Wagner et al. 2014), Paper V analyzes *how* social capital, processes of creating shared understanding, and the integration of HIS and clinical reality interrelate. In line with the triangulation strategy of this thesis, an in-depth case study of a single HIS implementation project was conducted.

Paper V theorizes that IT and medical professionals need to consciously interrelate HIS and clinical reality to leverage the full potentials of HIS. This implies that both parties identify, negotiate and implement necessary adjustments (Lapointe and Rivard 2005; Poon et al. 2004). Designing and implementing such reciprocal changes to HIS and medical structures and processes requires all stakeholders to integrate their specialized and dispersed knowledge, their expertise, and their expectations (Rousse and Deltour 2012). Ultimately, these processes enable them to create shared understandings about how HIS and socio-organizational complementarities need to be adjusted and integrated. Constituting "flexible conduits for the sharing and exchange of knowledge" (Subramaniam and Youndt 2005, p. 452), social capital between medical stakeholders and IT professionals is assumed to impact these processes and eventually affects the outcomes of HIS implementation (i.e., an instance of OBITA processes).

The empirical findings of Paper V, as summarized in Figure 8, demonstrate that the outcomes of OBITA processes such as HIS implementation projects are contingent on the capacity of involved IT and medical professionals to integrate their idiosyncratic knowledge and to develop an integrated account of how HIS will affect and is affected by medical reality. Confirming recent research, Paper V shows that integrating operational domain knowledge and IT knowledge is critical for OBITA processes (van den Hooff and de Winter 2011; Wagner et al. 2014). Extending these findings, it is shown that both IT and medical professionals must engage in iterative negotiation and interrelate their viewpoints on and expectations about HIS initiatives. These processes are found to be key in contexts that are characterized by highly autonomous and decoupled professional groups.

Moreover, Paper V reveals a reciprocal interplay between social capital and the outcomes of knowledge integration processes. Paper V provides additional evidence that creating opportunities for interaction does not constitute a sufficient condition for knowledge integration, even though this is particularly necessary in 'decoupled' organizational contexts. Rather, the goodwill and the ability of stakeholders to integrate idiosyncratic knowledge as

⁹ Weeger, A., and Haase, M. 2016a. "How Social Capital between Medical and IT Professionals Shapes the Outcomes of Health Information System Implementation Endeavours," *European Conference on Information Systems*. Istanbul.

reflected by cognitive linkages such as shared representations, interpretations and systems of meanings is key. Concerning the cognitive linkages, the findings also point out that artefacts employed within OBITA processes may play a vital role. For instance, data analysis indicates that artefacts like spreadsheets and presentation slides have the capacity to enable or obstruct actors to mobilize the resources available within social relations.

As indicated by prior research, Paper V also shows empirically that the relationship between social capital and knowledge integration is not unidirectional (Rousse and Deltour 2012). Social capital was found to affect knowledge integration, and in turn, emerging shared understandings impact the social capital configuration of cross-functional teams, such as their goodwill to share knowledge. Additionally, Paper V shows that weaker relational linkages in initial stages facilitates sharing and integration of idiosyncratic knowledge and experiences, while strong ties in later stage facilitates adaptations to HIS and socio-organizational complementarities (i.e., exploitation of shared knowledge).

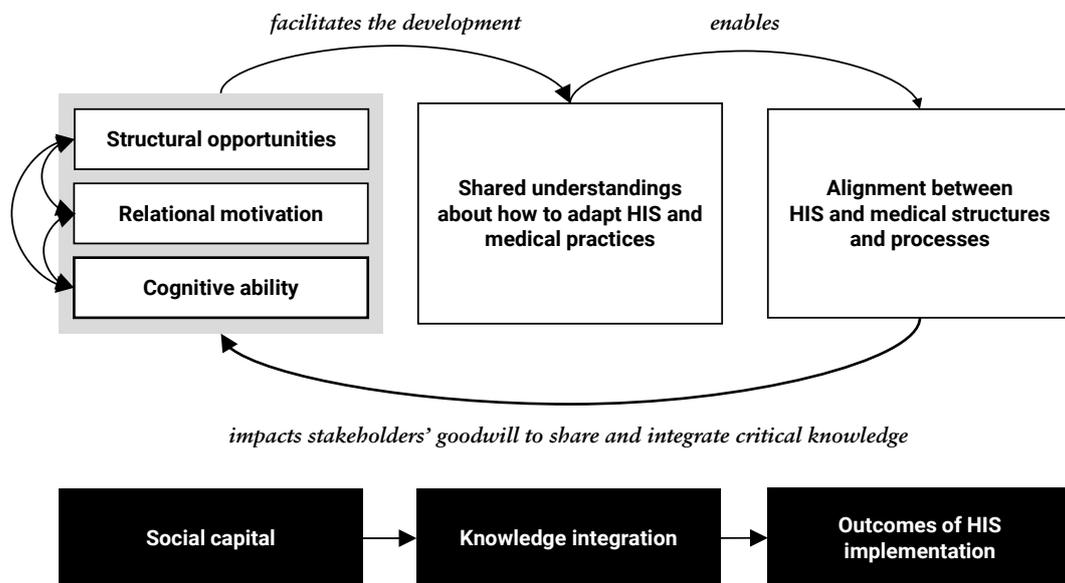


Figure 8: Summary of research results of Paper V

4.6 Paper VI: Bridging Boundaries in IS Projects ¹⁰

The findings of Paper V indicated that artefacts like spreadsheets and prototypes employed within OBITA processes may be key for creating shared understanding. Paper VI intends to broaden our knowledge on the influence of such artefacts. Augmenting the theoretical insights of prior research on boundary objects with AT, Paper VI sets out to identify the characteristics of project-related artifacts that enable business and IT to share and integrate

¹⁰ Weeger, A. 2017. “How Do Project-Related Artefacts Qualify for Bridging Boundaries in IS Implementation Projects—an Activity Theoretical Perspective,” *Hawaii International Conference on System Sciences*, Kona, HI.

idiosyncratic knowledge and eventually align HIS, medical structures and processes efficiently.

Augmenting prior literature on boundary objects (Carlile 2002; Carlile 2004; Levina and Vaast 2005; Nicolini et al. 2012; Star and Griesemer 1989; Wenger 1998) with concepts from AT and analyzing data of a single in-depth case study revealed three characteristics of project-related artefacts. These characteristics were found to determine their ability to enable and/or support IT and medical professionals in aligning HIS (abilities and characteristics) with medical structures and processes during OBITA processes such as IS implementation. First, IT and medical professionals need to utilize the artefacts as instruments or objects in their activities. The artefacts must be thus capable of linking their activity systems. This can be done by actual implementation (e.g., using a prototype within a real-world scenario) or by internalization mechanisms that enable people to try potential interactions with reality without performing actual manipulations (e.g., mental simulations). Second, artefacts need to facilitate translation of knowledge about key elements of the activity systems. Third, artefacts need to provide a common information space that enables the distinct communities of practice (i.e., IT and medical stakeholders) to recognize contradictions in the activity systems, particularly those that OBITA processes aim to resolve or mitigate and those that may arise. These findings are summarized in Figure 9.

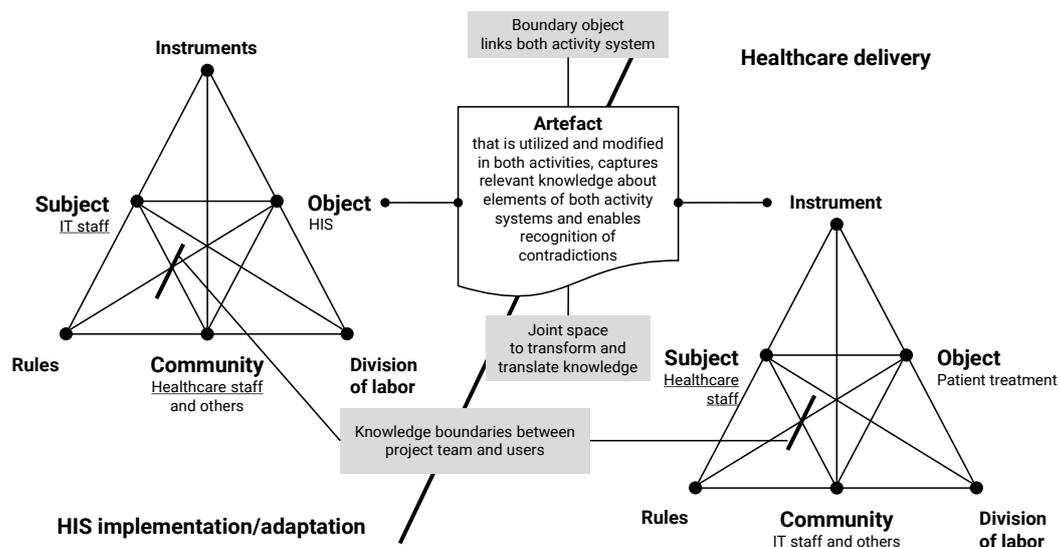


Figure 9: Summary of research results of Paper VI

In summary, the findings of Paper VI go beyond the frequently cited need of interpretative flexibility and concretizes the structural properties that enable what Star and Griesemer (1989) call “the process of tacking back-and-forth between the ill-structured and well-structured aspects of the arrangements”, which is necessary for interdisciplinary problem-solving. Moreover, applying AT to extend the notion of boundary objects confirms and extend prior literature stating that bridging knowledge boundaries requires not only persons but also artefacts to become legitimate participants in the activities of distinct professional groups (Levina and Vaast 2005).

4.7 Paper VII: On IS Implementation Context ¹¹

The empirical evidence of the papers analyzing OBITA processes aimed at adapting existing HIS or implementing new HIS (Papers IV-VI) show a striking similarity: misalignments between HIS and medical structures could have been ascribed to lack of awareness of contextual complexities. Previous IS research does not offer much guidance for understanding the full spectrum of complexities influencing the development, implementation, and use of IS (Williams and Pollock 2012) and some scholars even argue that much of the contemporary IS implementation knowledge largely neglects contextual particularities (Avgerou 2001). Informed by AT, Paper VII sets out to contribute to our knowledge in this area by identifying important aspects of the context, which are frequently overlooked but need to be considered during OBITA processes such as HIS implementation and change.

Informed by AT, the context is conceptualized as the elements of the activity systems targeted by OBITA processes, their interrelations and tensions between. Taking this perspective, the process and outcomes of seven minor implementation projects in a large German teaching hospital were analyzed. Findings reveal that the contested, mediated, situated and provisional nature of the activities affected by the IS contributes to the complexity of the context and endangers implementation success and intended outcomes (i.e., OBITA outcomes).

The findings reveal that misalignments tackled by the minor HIS implementation projects (i.e., OBITA processes) can be traced back to contradictions related to HIS mediated subject-object relationships or contradictions related to rules and the division of labor. Moreover, the analysis of case study data reveals that implementation teams must be mindful of the tensions that characterize the activities affected and envision the mediating role of the IS within the activity systems. It is shown that ability to efficiently adapt HIS and medical structures requires reflection of the contested, mediated, situated, and provisional nature of medical activity and the potential for contradictions that arise. In times of change, this potential for contradictions is heightened as parts of older phases of activities often stay embedded in activity systems (Kuutti 1996). Thus, an understanding of the development of activity systems over time is often needed. Paper VII offers questions that may enable practitioners to illuminate these characteristics (see Section 5.2.1). Moreover, Paper VII concludes that OBITA processes must consider the level of individuals (i.e., the users) and the level of the collective (i.e., the context). The major findings are summarized in Table 15.

¹¹ Weeger, A., Haase, U., and Weitzel, T. "The "Known Unknowns" – Accounting for the Context and the Mediating Role of IS in Implementation Projects." – under review for publication in the European Journal for Information Systems (EJIS), first round

Table 15: Summary of research results of Paper VII

Aspects that contribute to the complexity of the context of HIS implementation

	<p>Healthcare delivery is characterized by different and often contested perspectives on the object of the collective activity, particularly concerning historical and emergent aspects that determine individual goals (i.e. it is contested).</p> <p>HIS can account for the perspectives differently and thus emphasize/create contradictions.</p>
	<p>Healthcare delivery is manifest in systems of tools, rules/norms and a division of labor, which cannot be considered in isolation (i.e., it is mediated).</p> <p>HIS can interfere with the other tools and conventions that mediate interests, traditions and interactions of individuals and communities and thus emphasize/create contradictions.</p>
	<p>Healthcare delivery enacted over time and in places reflects its history and is specific to particular contexts (i.e. it is situated).</p> <p>The role of HIS is, like healthcare delivery, constructed and constantly developing (i.e. it is provisional).</p> <p>HIS can contradict historical traces of healthcare activity and/or local variations of the activity.</p>

4.8 Paper VIII: Shared Understanding in HIS Implementation ¹²

Prior research including Papers IV-VII provides evidence that shared understanding facilitates the implementation of IS and can prevent unintended consequences such as misalignments (Charaf et al. 2013; Tesch et al. 2009). However, there is a lack of clarity about the areas in which shared understanding is needed (Bittner and Leimeister 2014). To guide OBITA processes that are better able to resolve misalignments without creating new ones, Paper VIII sets out to provide a deeper understanding of the perspectives, knowledge, and experiences that people involved and affected by these processes need to share, integrate and agree on.

Paper VIII draws on the insights of Paper III and Paper VIII and theorizes that shared understanding is needed about knowledge about, experiences with and perspectives on the contested nature of healthcare activities that are affected by OBITA processes such as HIS implementation. Based on the analysis of data collected in two case studies, it is found that issues and misalignments emerging during implementation can be traced back to a lack of shared understanding of the activity systems affected by the new HIS, i.e. the socio-organizational environment the HIS is embedded in. Case study data shows that the participants in the implementation projects could identify the key stakeholders, their individual expectations, obvious properties of the legacy instruments related to individual tasks and important regulatory needs. However, they failed to share and integrate their knowledge and experiences about contradictions within the affected activity systems, particularly concerning the object and the wider socio-organizational context involving the rules and the division of labor that evolve over time and how the HIS relates to these. A lack of shared understanding in these areas was found to jeopardize intended OBITA outcomes such as improved efficiency.

In summary, Paper VIII posits that shared understanding about three socio-organizational characteristics of the activities affected by HIS implementation is needed: HIS-mediated relationships between the subject, the community, and the object; HIS-mediated relationships between the division of labor and the object; and HIS-mediated relationships between the rules and the object. The findings thus provide further evidence of the significance of the relationships identified in Paper III. Extending these findings, Paper VIII shows that sharing and integrating knowledge, experiences, and perspectives concerning these relationships facilitate resolution of existing misalignment, while avoiding the emergence of new misalignments and, ultimately, IS implementation failure.

¹² Weeger, A., Weitzel, T., and Gewald, H. "The Unintended Consequences of Insufficient Shared Understanding – an Activity Theory-Based Framework to Guide Health IS Implementation." – under review for publication in the Business Information Systems Engineering (BISE), first round

This submission is based on a previous paper: Weeger, A., and Ott-Schwenk, A. 2017. "What Teams Need to Be Clear About-an Activity Theoretical Perspective on Shared Understanding in Health IS Implementation," *Internationale Tagung Wirtschaftsinformatik (WI)*, St. Gallen. (Best Paper Nomination)

Table 16: Summary of empirical results of Paper VIII

Characteristics covered by shared understanding	Characteristics <u>not</u> covered by shared understanding
Primary users of the HIS and occupational groups involved in the activities that are affected by the HIS	Contradictory perspectives on the objective of healthcare activities (e.g., caring for patients vs. documentation quality and costs) that evolved over time and result in different interpretations of the role of the HIS within the collective activity – the relation between the HIS and contradictions associated with the object
Expected individual performance gains (e.g., documentation, reimbursement) – the requirements on the HIS based on individual goals	
Obvious properties of the legacy instruments (e.g., types of data-fields, forms, reports) related to individual tasks – the requirements on the HIS derived from the material properties of the legacy instrument that enables individuals to perform their task	Enhancements of the documentation instruments that enable them to support the roles and interactions of health care personnel (e.g., by governing case reviews) – the relation between the HIS and the division of labor that have developed over time.
New regulatory requirements (e.g., transparency, authentication, and medication handling) – requirements on the HIS related to the explicit regulatory limitations of the activity	Interpretation and implementation of explicit and implicit rules that evolve over time – the relation between the HIS and contradictions associated with the rules that characterize the activity

4.9 Paper IX: On the Dynamics of Business-IT Alignment ¹³

After studying the triggers of OBITA processes (i.e., misalignments between HIS and medical structures and processes) and facilitators of these processes (i.e., cross-domain interconnectedness and shared understanding), Paper IX aims to further enhance our theoretical understanding of the underlying mechanism of OBITA. Drawing on the insights of Paper VI, Paper VII, and Paper VIII, this paper tackles three major limitations of alignment research as identified by Gerow et al. (2014b), Coltman et al. (2015), Chan and Reich (2007b), and Luftman et al. (2015): the tendency to regard alignment as a more or less static state resulting from linear cause-effect relationships; an insufficient grounding of alignment research in mature theories; and limited applicability of alignment constructs for detecting and approaching misalignments.

Paper IX argues that analyzing OBITA processes using concepts of AT enables IS research to address these limitations. Following this line of thought, OBITA is defined as a continuous

¹³ Weeger, A., and Haase, U. 2016c. “Taking up Three Challenges to Business-IT Alignment Research by the Use of Activity Theory,” *International Journal of IT/Business Alignment and Governance* (7:2), pp. 1-21.

This submission is based on a previous paper: Weeger, A., and Haase, U. 2016b. “How Contradictions Facilitate Evolutionary Transformation: An Exploration into the Dynamics of Business-IT Alignment from the Perspective of Activity Theory,” *European Conference on Information Systems*. Istanbul.

process of consciously resolving contradictions within and between the interrelated activity systems of business and IT and its elements to contribute to an organization's performance over time. Paper IX theorizes that OBITA processes are aimed at transforming activity systems of business and IT by interrelating the components (processes, infrastructures and technologies) and reducing structural tensions within and between the systems. Organizations usually trigger these transformations to facilitate efficient and effective IT support for business activities.

Data of a single, in-depth case study involving six years of reciprocal transformation of business and IT activity systems in a large German hospital provided input for the enhancement of the activity theoretical perspective on business-IT alignment and served as illustration for its applicability. Findings reveal that the IT-related organizational change efforts that took place during the six years under consideration can be traced back to contradictions and tensions within the general activity system of patient treatment. These were caused by externally induced changes such as altered reimbursement policies (i.e., changes to rules) and increased demand for collaboration between healthcare providers and sites (i.e., changes to the division of labor). Typically, resolving the contradictions and tensions in the activity system underpinning patient treatment was related to the adaptation of existing HIS and the implementation of new HIS. However, the activity system underpinning IT delivery and change activities was found to be unable to adapt and implement these HIS efficiently. Consequently, analysis uncovered contradictions between both activity systems. These, in turn, could be traced back to tensions within the IT activity system such as conflicting modes of task distribution and accountability. Figure 10 depicts these dependencies in a simplified form.

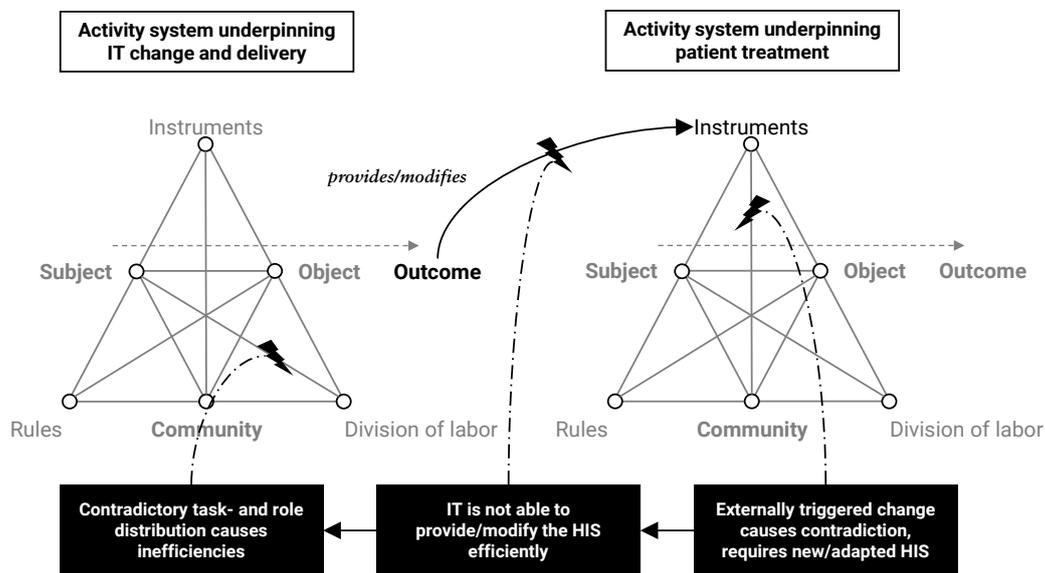


Figure 10: Simplified representation of dependencies between the activity systems (no consideration of reciprocal effects)

Concerning alignment processes, longitudinal case study data indicates that resolving the contradictions that emerged within and between the activity systems unfolded in an iterative

process of reciprocal changes to elements of both systems. Overall, this co-evolutionary process was found to explain how and why organizational performance improved over time. Thus, Paper IX provides evidence that OBITA processes encompass a sequence of iterative transformation intended to solve local tensions. Moreover, the analysis reveals that activity system driven analysis may help practitioners to identify and approach tensions and underlying contradictions.

4.10 Summary

This dissertation includes nine papers. By triangulating theories, research paradigms and methods, the papers offer diverse theoretical and empirical findings that provide answers to the research questions. The results enhance our understanding about the role and the functioning of the key constructs spanning OBITA as identified by prior research. The main findings are briefly summarized along the nomological network of OBITA in Figure 11. The manifold contributions of these findings to theory and practice are discussed in the following section.

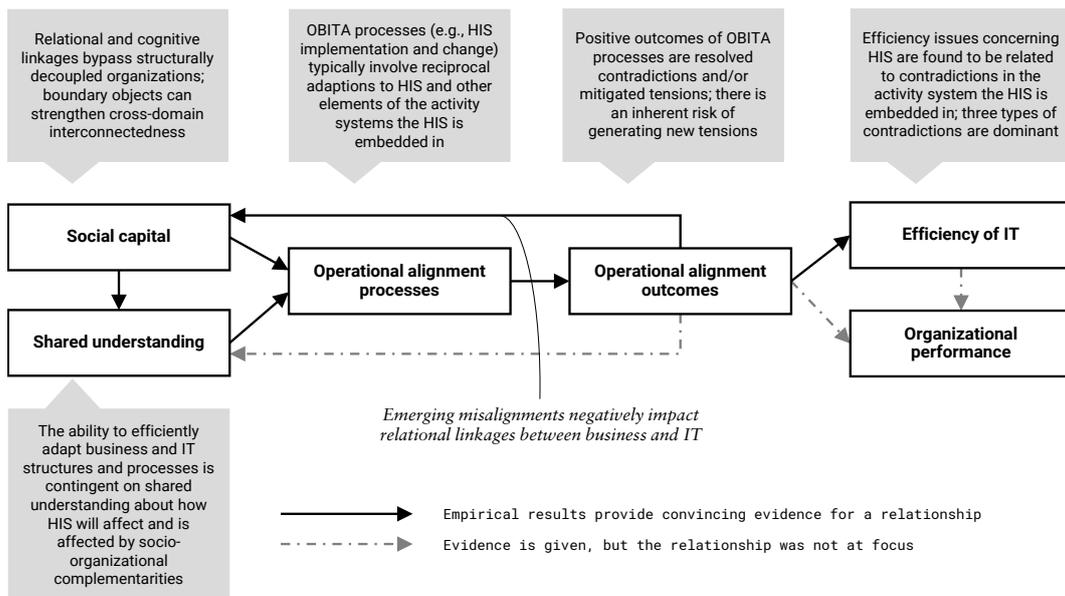


Figure 11: Summary of the main research results concerning the nomological network

5 DISCUSSION

The following sections discuss how the results of the nine papers of this cumulative dissertation section contribute to theory and their implications for practice. In addition, the theoretical findings are synthesized into an internally consistent explanation of how alignment occurs at the operational level. Finally, after acknowledging the limitations of this research, avenues for further research are outlined.

5.1 Contributions to Theory

Before the contributions regarding the detailed research questions as presented in Section 2.4 are discussed, it is shown how this dissertation extends the concept of OBITA. Then misalignments concerned with the integration of organizational structures and processes of hospitals and HIS are discussed (RQ 1). Subsequently, the contributions to the characteristics and dynamics of the social dimension are presented (RQ 2). After discussing the ability to align business and IT (RQ 3), the theoretical insights concerning OBITA process are reflected and the foundations of a process theory of HIS-related change are developed (RQ 4).

5.1.1 The OBITA Concept

Though Henderson and Venkatraman (1999, p. 476) already expanded the focus of business-IT alignment to the “corresponding internal domains” of alignment early on, most research in IS was limited to the “strategic integration” of business and IT (Chan and Reich 2007b; Gerow et al. 2016). Recently, scholars have called for a specific focus on the operational level and for developing conceptualizations that clearly delimit OBITA from other alignment types (Chan and Reich 2007b; Gerow et al. 2016). This dissertation heeds these calls by providing a structured literature review on OBITA and offers a thorough conceptualization of OBITA based on and extends the strategic alignment model (Henderson and Venkatraman 1999) and the types of alignment as identified by Gerow et al. (2014b). Based on this conceptualization, key-concepts as discussed by prior research are synthesized in a nomological network (this paper). Among others, it is theorized that OBITA has two distinct dimensions: social and functional integration between business and IT. By locating these dimensions in the SAM distinguishing them clearly from other dimensions, this paper refines prior notions of the multidimensionality of OBITA (Lee et al. 2008). Moreover, it is empirically shown that both dimensions reciprocally influence each other (Paper V). Thus, this dissertation also responds to the call to clarify the relationship between social alignment at operational levels and functional integration (Gerow et al. 2016), at least for structurally ‘decoupled’ organizational like hospitals. Moreover, the papers included in this dissertation not only substantiate the concept of OBITA and clarify the interrelations between its dimensions, but also investigates more deeply the constituents, characteristics, and mechanisms of OBITA. The related contributions to theory are discussed in the subsequent sections.

The literature review reveals that studies analyzing OBITA employ a variety of theories, which lead to different and sometimes inconsistent insights (this paper). As a response to this limitation, this dissertation develops an activity theoretical perspective on OBITA that integrates the different views on alignment and may lead to more consistent findings in the future (outlined in Paper IX). How the integrated view extends prior research is discussed below.

First, prior research typically considered the functional (e.g., Dreiling et al. 2006; Vessey and Ward 2013) and the social dimension (e.g., Wagner et al. 2014; Zolper et al. 2014) of OBITA separately. In contrast, the activity theoretical perspective developed and enhanced in Paper III, Paper VII, VIII, and Paper IX provides an integrated account for the technological and social components of the business-IT relationship. Moreover, this thesis shows theoretically and empirically that both dimensions interrelate and should be considered concurrently

(Paper V, Paper VII, and Paper VIII). Figure 12 shows how the functional and the social dimension of OBITA are reflected in activity system diagrams.

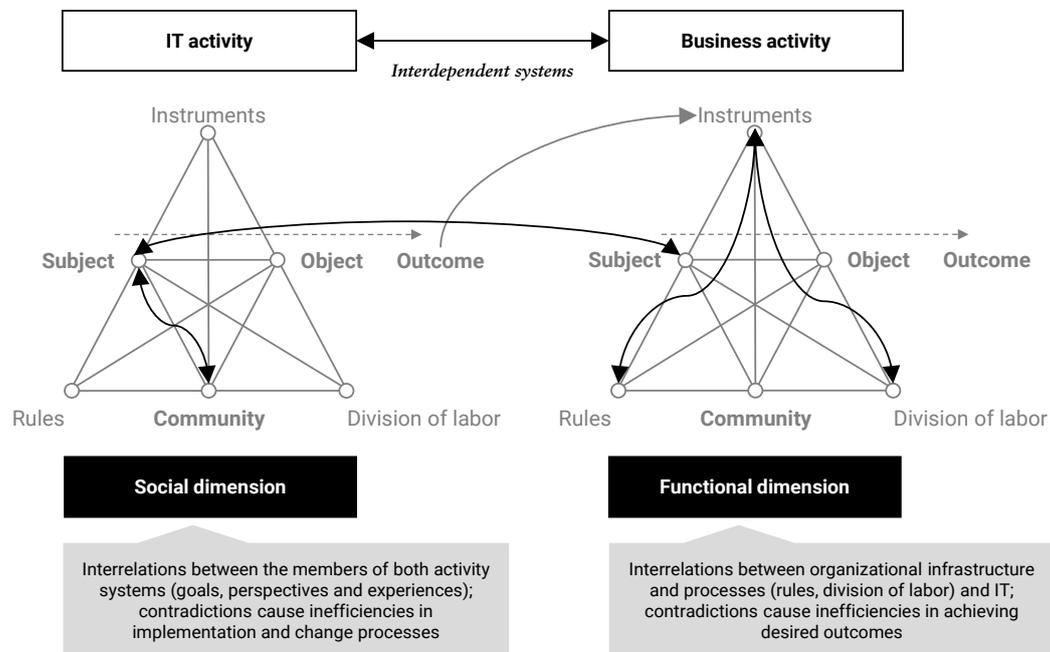


Figure 12: Activity theory integrates the social and functional dimensions of OBITA

Second, the activity theoretical perspective takes a collective, artifact-mediated and object-oriented activity system that is seen in its network relations to other activity systems as the prime unit of analysis (Engeström 2001). The activity system concept captures not only all functional and social components of the business-IT relationship at the operational level as discussed by prior research (see Table 3 and Table 4), but also captures various levels of this relationship. As shown in Paper IX, IT and business activity systems can be analyzed at an organizational-level perspective. Likewise, the activity theoretical perspective enables scholars and practitioners to zoom in at a department or group level to analyze, for instance, HIS mediated activities at a ward and the related HIS change activity (Paper VII, and Paper VIII). Last not least, using activity systems as the unit of analysis also enables consideration of the historicity of the activity and its participants as it allows for analyzing different modes of the activity (e.g., present activity and a historically new form of the activity). As indicated in Paper III, zooming in and out between the levels and comparing different modes of HIS-mediated activity enhances understanding on how HIS-related changes affect various levels (e.g., the individual and the organizational level). Moreover, as the activity system reflects a unified analytical tool that can be applied at various levels, activity theoretical analyses should yield more comparable results.

Third, the activity theoretical perspective avoids a deterministic logic in favor of explanations based on the dynamics of social processes at work, as called for by previous research (Chan and Reich 2007b; Grant 2010). Extending prior research viewing alignment as a dynamic, multi-faceted, and non-deterministic process (Benbya and McKelvey 2006; Vessey and Ward

2013), it is shown that alignment journeys (Chan 2002) are triggered by emergent and historically accumulated contradictions and tensions within and between work activities and unfold as continuous processes of adjusting underlying activity systems (Paper V, Paper VI, Paper VII, and Paper VIII; see also Section 5.1.5 in this paper). Constituting the driving force for the evolution of activities through continuous adjustments of activity systems (Engeström 2001), the notion of contradictions sheds light upon the triggers of OBITA processes and enhances understanding of how changes to HIS and medical realities can be effectively approached (see below). However, viewing OBITA processes as a means to resolve contradictions and mitigate tensions within activity systems facilitates viewing OBITA as a continuous process of adapting activity systems. Activity theory also acknowledges that qualitative transformations of activity systems may lead to temporary stabilization (Allen et al. 2013a). Thus, it does not rule out the potential for a punctuated equilibrium as argued by another stream of alignment research (Burton-Jones et al. 2013).

Forth, the activity theoretical perspective on OBITA extends prior efforts to understand and improve alignment by applying scale-free dynamics (Benbya and McKelvey 2006). While Benbya and McKelvey (2006) already proposed considering tensions as a means of facilitating co-evolutionary dynamics, what they call ‘management by tension’, they specify neither the nature of these tensions nor how they could be approached in management interventions. This dissertation shows that taking an activity theoretical perspective enables research to derive much-needed actionable recommendation for practice (Luftman et al. 2015), demonstrating, for example, that analyzing business and IT as activity systems can help identify contradictions and tensions and explain why they emerge and how they can be approached (Paper VII, Paper VIII, and Paper IX). The recommendations for practice derived in this research are discussed in Section 5.2.

Table 17: Summary of contributions to the OBITA concept

Past research	Contribution
Identification of different dimensions of alignment; unclear differentiation among the dimensions	Substantiation of the concept of operational alignment; identification of the social and functional dimensions; delimitation of the social dimension of strategic and operational alignment (this paper)
Ambiguity concerning the interrelations between the social and functional dimension of OBITA	Theoretical and empirical evidence for a reciprocal relationship between the social and functional dimension of OBITA (Paper V, Paper VII, and Paper VIII)
Prior research used different units of analysis and employed different concepts to describe and analyze these units	Position of the activity system as the primary unit of analysis that captures all components of the business-IT relationship as discussed by prior research and offers the possibility to zoom in and out (Paper III, Paper IX)

Past research	Contribution
The few studies on OBITA employ a variety of different theories that yield partly inconsistent findings	Development of an integrated theoretical perspective on OBITA based on activity theory (integrates the different views on alignment, makes sense of the different findings and enables research to derive more actionable recommendations for practice) (Paper IX)

5.1.2 Functional Dimension of OBITA: Misalignments and Effects in Healthcare

Prior IS research focusing on HIS has had difficulties accounting for and integrating contextual factors specific to healthcare (Abouzahra et al. 2015), particularly concerning its historically established social structures such as distinct hierarchies and professionalism (Fichman et al. 2011; Halford et al. 2010). Consequently, prior research calls for complementing the knowledge base of IS research by accounting for the unique characteristics of the healthcare sector (Goh et al. 2011). This dissertation contributes to bridging this gap by identifying contextual factors, studying how the interplay between these factors and the characteristics of HIS produce misalignment, and how this interplay influences HIS usage and its outcomes (Paper I, Paper II, and Paper III). The specific contributions are outlined below.

First, Paper I shows that healthcare-specific characteristics like hospital structures, multiple and distinct hierarchies as well as the presence of a strong professional identity, often contradict HIS usage, foster resistance to IT-related change, and thus inhibit OBITA processes. Drawing on social cognitive theory (Bandura 1986), the observed misalignments between HIS and characteristics of the healthcare context were found to be shaped in a dynamic interplay between personal factors, environmental factors, and actual behavior. Moreover, Paper I points out the significance of altruistic motives of healthcare professionals and anxieties concerning restrictions in their professional autonomy. The findings imply that existing constructs used to study HIS adoption and use need to be adapted. Among others, the findings of Paper I contribute to the development of the comprehensive HIS use model as proposed by Abouzahra et al. (2015), theorizing that threats to role identity play a critical role in physicians' use of HIS.

Second, this dissertation contributes to closing a knowledge gap concerning the socio-technical demands of effective HIS as pointed out by prior research (Tan and Or 2015). Paper II is one of the first studies to provide a perspective on the relationship between distinct types of misalignments and HIS usage patterns (i.e., effective and ineffective use of HIS). Paper II reveals the importance of latent structures of an IS, such as control and role structures incorporated in HIS independently of its organizational embedding. Thus, it confirms the findings of Strong and Volkoff (2010) and extends prior research on HIS usage (Abouzahra et al. 2015). Paper II shows that efficiency of HIS usage is not only contingent on data, functionality, and usability-related misalignments, but also on the interplay between HIS's latent structures and the associated organizational analogues (e.g., historically evolved local requirements concerning the traceability of data access). Revealing that misalignments between manifest (e.g., data, functionality, and usability) and latent structures of the HIS and

the socio-organizational use-context produce ineffective HIS usage patterns, Paper II provides explanations for why HIS deployments may fail to realize their intended benefits.

Third, to further develop theory about how, why, and when possibilities for action created by technology are realized by individuals or groups of individuals, Strong et al. (2014) call for a more exploration of the realization of the HIS affordances they have identified. Though little research in IS analyzes affordance actualization (i.e., realizing the potential of IT for goal-oriented behavior) (Pozzi et al. 2014), there is some evidence that applying an affordance lens enhances understanding of HIS-related change (Strong et al. 2014). Paper III contributes to this stream by showing that the realization of HIS affordances relates to its manifest and latent structures, its interrelation with other activity system components as well as their complementary nature and dynamic interplay. Enhancing the theoretical knowledge about the role HIS and contextual features play, Paper III identifies three types of contradictions within healthcare activity systems that provide explanation for why affordances of HIS are realized. Paper III also contributes to affordance literature by offering a theoretical account that explains why affordances of HIS are not shared by all members of a group or an entire organization and why affordances that emerge as a combination of distinct affordances are not realized, as problematized by Strong et al. (2014) and Leonardi (2013). As value of IT is only realized if it is used effectively (i.e., realizing its intended possibilities for action) (Burton-Jones and Grange 2013), Paper III contributes to existing literature on alignment by showing why and when HIS supports a hospital’s complementary assets at the operational level such as its medical and administrative processes (Rivard et al. 2006).

Overall, investigating the functional dimension of OBITA, this dissertation provides further evidence for the assumption that contextual realities of healthcare professionals are crucial in explaining their HIS usage and its outcomes (Mettler et al. 2017). The papers identify those characteristics that inhibit functional integration of HIS and medical structures and processes and create functional misalignments that influence adoption and use behavior of healthcare professionals, an area where prior research was found to produce only limited understanding (Fichman et al. 2011; Jones et al. 2014).

Table 18: *Summary of contributions to the functional dimension of OBITA*

Past research	Contribution
Limited applicability of existing theories for acceptance and use of technology in the healthcare sector	Contextualized theories of HIS acceptance and use should account for altruistic motives of healthcare professionals and anxieties concerning restrictions in their professional autonomy (Paper I)
Despite a wealth of studies that highlight possible barriers to and facilitators of HIS implementation initiatives, a knowledge gap exists concerning the socio-technical demands of effective systems	Effective use of HIS relates to misalignments between the structures incorporated in an HIS and the associated structures of the organizational in-use context (Paper II)

Past research	Contribution
Realization of IT affordances was found to be dependent on three key factors: individual abilities and preferences, the technologies' features and the work environments' characteristics	Additional empirical evidence that supports affordance theory (Paper III) Augmenting affordance theory with AT increases its analytical and explanatory power: activity systems enable systematical analysis of the key factors that drive realization of IT affordances and specifies work environment characteristics; contradictions within and between these factors explain and predict realization of affordances (Paper III)
Contextual realities of healthcare professionals are crucial in explaining their HIS usage and its outcomes	Theory-driven identification of three contextual characteristics that inhibit insufficient integration of IT and complementary socio-organizational resources, which influence adoption and use behavior of healthcare professionals (Paper III)

5.1.3 Social Dimension of OBITA: Cross-domain Interconnectedness

Prior research highlighted the importance of the social dimension of OBITA, which characterizes the relationships between business and IT staff at the operational level and builds the foundation for effective functional integration (Schlosser et al. 2015; Wagner et al. 2014). Moreover, prior research indicates that social capital provides a sound theoretical lens for studying the nature and effects of cross-domain interconnectedness between business and IT staff at the operational level and that social capital facilitates OBITA processes (Schlosser et al. 2015; Wagner et al. 2014; Zolper et al. 2014). However, little research explicitly explains *how* and *why* social capital facilitates OBITA, particularly in 'decoupled' organizations like hospitals.

Paper IV and Paper V address this knowledge gap and improve our understanding about how the structural characteristic of hospitals can be mitigated and OBITA facilitated. First, Paper IV confirms the findings of prior research and shows that social capital positively influences functional integration of business and IT infrastructure and processes and ultimately IT business value (Wagner et al. 2014; Zolper et al. 2014). Extending the findings of prior research, Paper IV contributes by demonstrating that the effect of social capital between business and IT on IT-business value is mediated through OBITA processes that rely on effective cross-functional cooperation. Both the OBITA processes as such and their outcomes (i.e., tight integration of HIS and medical structures and processes) explain a large share of the variance in IT business value. Thus, Paper IV also indicates that engaging in cross-functional cooperation is per se valuable. Such engagements may, on the one hand, improve the ability of IT professionals to provide support for the HIS more effectively and, on the other hand, sensitize medical professionals to the possibilities for goal-directed action that HIS creates.

Second, Paper V contributes by showing that strong social capital between IT and medical stakeholders as well as strong social capital between the divergent medical occupational groups facilitates knowledge integration processes required for effective OBITA processes.

Moreover, Paper V shows that this effect is not unidirectional but that failures in developing such understanding result in misalignments, which, in turn, negatively impact social capital. Without heedful interventions, these effects reinforce each other and hence obstruct OBITA processes. Thus, Paper V extends prior research by confirming sparse empirical evidence that there is a self-reinforcing reciprocal two-way relationship between knowledge integration and social capital (Rousse and Deltour 2012).

Third, Paper V contributes to literature demonstrating that, depending on the task, social capital comes with benefits and risks (Adler and Kwon 2002). Particularly strong relational social capital was found to have the potential to cover cognitive gaps between stakeholders and thus inhibits them to integrate their knowledge and to disclose and negotiate their interests. Extending prior research on social capital and interdisciplinary cooperation, Paper V indicates that early project phases may benefit from strong structural and weaker relational social capital (Eriksson 2013).

Overall, Paper IV and Paper V contribute that cross-domain interconnectedness reflected by strong social capital between IT and medical professionals is particularly beneficial for structurally decoupled healthcare organizations. Prior assumptions that coordination between IT and business units “must extend well beyond the system implementation stage, and ongoing coordination between the two functions is critical for achieving more integrated information systems” (Bharadwaj et al. 2007, p. 449) are confirmed and theoretical explanations for how and why social capital facilitates the integration of IT and business structures and processes in healthcare are given.

Table 19: Summary of contributions to social capital theory

Past research	Contribution
IT-business social capital facilitates OBITA processes and is positively related to business value of IT in industry settings	Social capital bridges structurally decoupled healthcare organizations (Paper IV and Paper V)
	The effect of social capital on OBITA processes and IT-business value is mediated by the ability of IT and medical professionals to unfold effective cross-functional cooperation in daily business (Paper IV and Paper V)
	OBITA processes are contingent on social capital between IT and medical stakeholders and social capital between different occupational groups (Paper V)
Social capital transforms how knowledge integration occurs during a project	Depending on the task and project progress, the dimensions of social capital may have positive and negative effects on knowledge integration processes (Paper V)
There is a bi-directional relationship between social capital and knowledge integration processes	These effects have the potential to reinforce each other and significantly obstruct OBITA processes (Paper V)

5.1.4 Ability to Align Business and IT: Shared Understanding

Prior research on social OBITA shows that the ability to align business and IT is contingent on shared understanding between business and IT professionals (Benbya and McKelvey 2006; Gerow et al. 2014a; Martin et al. 2008; Schlosser et al. 2015; Vermerris et al. 2014; Wagner et al. 2014 ; Wagner and Weitzel 2012). However, the kind of knowledge that needs to be shared during by OBITA processes remains unclear, particularly considering the complexities of the healthcare domain (Wildman et al. 2014). This dissertation contributes to prior research by uncovering the nature and contents of shared understanding that allow people involved in OBITA processes effectively harmonize HIS and the distinct structures and processes of healthcare delivery. Moreover, it broadens our knowledge concerning factors that facilitate the emergence of such understanding.

First, this dissertation contributes to research by revealing what needs to be covered by shared understanding that facilitates OBITA processes (Paper VII, Paper VIII). Paper VII identifies and synthesizes the HIS-related aspects of healthcare activities that constitute the in-use context and contribute to the complexity of OBITA processes such as HIS implementation and change (see Table 4 in Paper VII). As the type and nature of contextual particularities surrounding IS implementation and change has been identified as a major weakness in IS research (Avgerou 2001; Dwivedi et al. 2015; Williams and Pollock 2012) and, if considered, hardly concerned with the actual in-use context (i.e., the operational level) (Schryen 2012; Staehr et al. 2012), this constitutes an important contribution.

Extending these findings, Paper VIII contributes an activity-theoretical framework capturing three socio-technical aspects of healthcare activities about which a shared understanding is needed during OBITA processes (see Figure 3 in Paper VIII). The aspects relate to instrument-mediated relationships within activity systems. Shared understanding about how HIS affects these relationships enable actors involved in OBITA processes to resolve existing contradictions or mitigate tensions within the activity systems, without creating or amplifying others. On the contrary, being unaware of these HIS-mediated relationships increases the change of the emergence of unintended consequences such as inefficiencies and resistance among key-users. By contributing a theoretically grounded classification of characteristics of collective activities that should be shared and integrated when implementing or adapting HIS, this dissertation also responds to the call for research on the socio-technical complexities HIS is facing (Bittner and Leimeister 2014) and significantly enhances our knowledge concerning when and how shared understanding facilitates OBITA processes.

Second, these findings also extend prior research on social OBITA, which emphasizes the significance of IT professionals' application domain knowledge (Schlosser et al. 2015; Wagner et al. 2014). However, medical professionals' knowledge about the possibilities and limitations of the system was also found to be critical for purposeful adapting HIS. Sufficient understanding about the complexities, possibilities and limitations of IT increases the chance that important knowledge concerning HIS-related aspects of healthcare activities is shared, particularly knowledge that is socialized, embedded and invested in medical practice (Paper V and Paper VI). Thus, this thesis also contributes by sensitizing IS research not to overemphasize domain knowledge of IT professionals, but to view medical professionals' knowledge about opportunities and limitations of HIS and IT professionals' knowledge of medical structures and processes as equally important for OBITA processes.

Third, the findings enhance our knowledge concerning factors that facilitate the emergence of shared understanding. As discussed in the last section, social capital was found to facilitate sharing and integrating knowledge that is socialized and embedded in practice. Moreover, this thesis contributes by revealing the characteristics of project-related artefacts that facilitate the development of shared understanding. By augmenting boundary object theory with AT, Paper VI shows that such artefacts need to be utilized and modified in IT and business activities, capture relevant knowledge about elements of both systems, and enable actors involved in OBITA processes to recognize existing and anticipate new contradictions and tensions. Though limited to the local context of OBITA processes, Paper VI thus extends the global representational characteristics of boundary objects as discussed in prior research (Carlile 2002; Carlile 2004; Star 1989).

Table 20: *Summary of contributions to the concept of shared understanding in IT-related change processes*

Past research	Contribution
Prior research argues that IS research and practice need to associate technology innovation with the context within which it is embedded; however, studies hardly consider and analyze the complexities of the operational in-use context	Activity-theoretical framework of HIS-related aspects of healthcare activities that illuminates the context of OBITA processes and raises scholars' and practitioners' awareness about its complexities (Paper VII)
Shared understanding between business and IT professionals facilitates OBITA processes such as IT implementation and change; there is a lack of clarity about the areas in which shared understanding is needed	Activity-theoretical framework of socio-technical aspects of healthcare activities (i.e., the operational in-use context) about which a shared understanding is needed (Paper VIII)
IS research found a large array of artefacts that qualify as boundary objects and facilitate the development of shared understanding (offering common information spaces and to functioning as translation and transformation devices at the knowledge boundaries)	Extension of the generic characteristics of boundary objects for OBITA processes: these objects are utilized in both activity system, capture socialized knowledge of affected activity systems, and enable the recognition of contradictions (Paper VI)

5.1.5 OBITA Processes: Theoretical Reflections on IT-related change

Prior research calls for a consistent explanation of how OBITA occurs and can be sustained in a way that allows predictions and actionable recommendations to be derived (Burton-Jones et al. 2013; Luftman et al. 2015; Vessey and Ward 2013). As outlined above, this dissertation yields several theoretical insights on alignment at the operational level that serve this aim. In this section, the contributions of the papers are consolidated and the foundations of a process-theory of HIS-related organizational change is developed. This theory aims at offering a more comprehensive understanding about how IT and organizational structures and processes can be efficiently integrated. Thus, it responds to recent calls to develop theories that provide the foundations for developing approaches to achieving and sustaining OBITA (Vessey and Ward 2013). To approach this goal, existing theories on alignment processes based on the complexity theory worldview (Benbya and McKelvey 2006; Vessey and Ward 2013) are complemented and extended by the activity theoretical insights gained

in this dissertation and the affordance actualization theory as proposed by Strong et al. (2014).

This section begins with reflecting the ultimate outcomes of OBITA processes. After that, it is theorized that achievement of these outcomes can be tied to IT utilization behaviors at multiple levels, which are ascribed to the interplay of actors and technology within organizational actor-environment systems. It is shown that these systems can be conceptualized as interrelated activity systems. Further, it is argued that contradictions and congruencies within and between these systems explain the emergence of IT utilization patterns and reveal potentials for IT-related change that improve business-IT alignment. Building on the arguments of complexity theory, it is shown that interrelated activity systems interact like complex adaptive systems, where changes in one system effects the structure and/or behavior of other systems. Moreover, it is theorized that effective paths for sustained alignment should foster co-evolutionary processes. Finally, it is shown that these paths can be identified by analyzing the network of related activity systems.

Though the resulting theory avoids a deterministic logic in favor of explanations based on the dynamics of social processes, it offers actionable recommendations for practitioners to move forward in their endeavors to realize the potentials of IT. Overall, this section expounds how this dissertation contributes to answering research question 4.

5.1.5.1 Organizational Performance and IT Utilization

In line with research on IT business value (Melville et al. 2004; Schryen 2012; Soh and Markus 1995), alignment research posits that OBITA effects overall organizational performance by facilitating business operations (see efficiency of IT in Table 5). IT that is well aligned with socio-organizational complementarities (e.g., processes, structures, and norms) enables and/or supports organizational actors to achieve concrete outcomes that positively impact business operations at multiple levels, such as standardization and coordination (Bharadwaj et al. 2007; Schryen 2012; Strong et al. 2014). These outcomes are contingent on if and how IT is utilized effectively (Schryen 2012; Soh and Markus 1995; Vermerris et al. 2014), which is positively influenced by social OBITA (Wagner et al. 2014). Moreover, these outcomes collectively contribute to achieving higher-level market-oriented goals such as profits and stock value (see organizational performance in Table 5).

Concerning these relationships, this dissertation shows that IT-related misalignments at the operational level inhibit organizations from achieving concrete outcomes such as improved coordination (see Paper II, Paper III, Paper VII, Paper VIII). On the contrary, if organizations manage to constantly integrate IT and complementary socio-organizational resources, IT is more likely to be appropriately used and concrete outcomes that facilitate business operations to be achieved (Paper II, Paper III, and Paper V).

Prior research shows that concrete outcomes of IT utilization emerge at the individual and organizational level (Strong et al. 2014). In the aggregate, individual-level outcomes of IT utilization may lead to organizational-level outcomes, which contribute to organizational goals. For instance, if physicians and nurses utilize HIS during anamnesis and care-giving activities to instantly capture digital data about patients and treatments consistently, follow-on organizational activities like clinical decision making, accounting, and research can draw on comprehensive electronic patient records. In the interplay with other organizational-level

outcomes such as increased standardization of operations, digital data about patients and treatment facilitates the achievement of organizational goals such as provision of high-quality patient care.

5.1.5.2 Concrete Outcomes and Activity Systems

Paper III reveals that the achievement of individual and organizational-level concrete outcomes is contingent on the realization of the affordances IT bestows. IT affordances and their realization, in turn, are dependent on the dynamic interplay of IT and organizational actors within interrelated actor-environment systems involving socio-organizational complementarities (i.e., structures and processes).

Introducing the notion of activity systems, AT offers an analytical concept to describe and analyze the structure of actor-environment systems in organizations at a manageable level of complexity (Kaptelinin et al. 1995; Kuutti 1991). The activity systems govern a goal-directed hierarchy of individual actions that aim to transform a common object and collectively contribute to the achievement of a joint outcome (Kaptelinin 2005). Goal-directed actions are mediated by the instruments employed (e.g., technology and other artefacts), socio-organizational complementarities (e.g., norms, rules, and the distribution of roles and responsibilities) and their dynamic interrelations (see Section 2.3.3).

Paper III offers evidence that the characteristics of activity systems determine if individual organizational actors realize IT affordances consistently and to the extent required for the achievement of organizational-level outcomes. For instance, it is shown that the actor-environment systems of organizations must foster healthcare professionals involved in patient treatment to capture digital data about patients. Otherwise a comprehensive electronic patient record will most likely not be achieved. For in in-depth discussion how activity systems influence the emergence and realization of IT affordances please see Paper III.

On the highest level of abstractions, organizations can be conceived of as a single activity system (Blackler et al. 2000). However, this level of abstraction blurs complexity and does not enable analysis of how IT utilization outcomes at the organizational level emerge as a complex aggregation of many lower-level IT utilization outcomes as argued above. Accounting for these effects, AT facilitates the conception of organizations networks of interrelated activity systems (ibid.). These networks link activities of different developmental states, different activities that are directed toward a common object, activities that involve the same or similar constituents (e.g., the same instruments and similar rules), and activities that are linked through their outcomes (e.g., one activity produces an instrument that is used in another activity). For a simplified example of how organizations can be conceptualized as interrelated activity systems please see Paper IX and Figure 14 below.

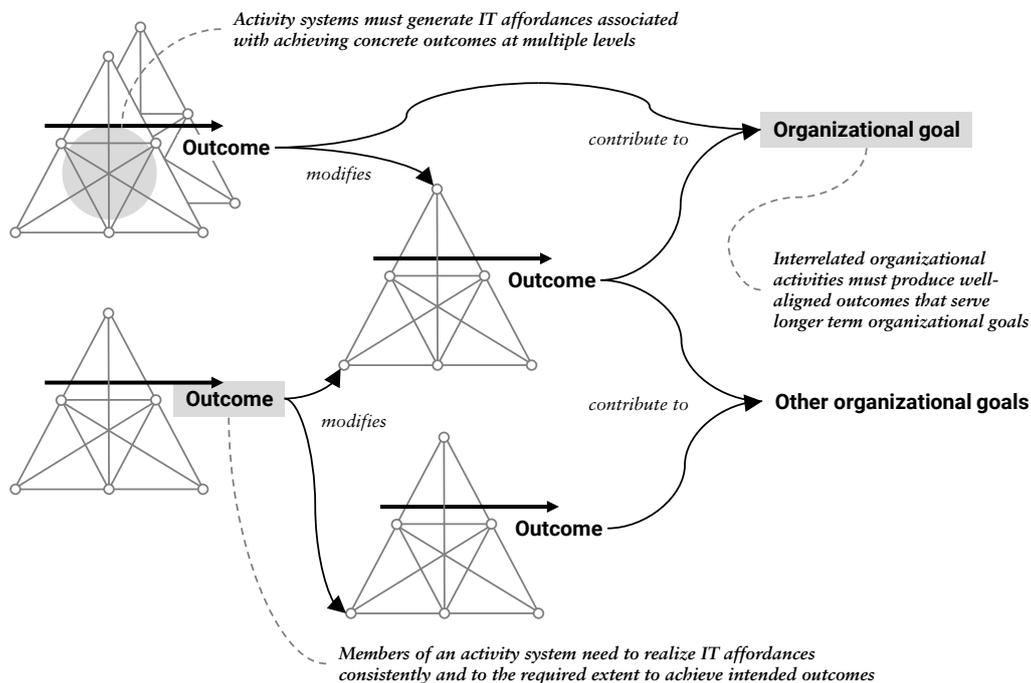


Figure 14: Organizations as interrelated activity systems

For instance, patient data (i.e., common object) is collected and transformed to create a comprehensive electronic patient record (i.e., concrete outcome) during multiple activities such as anamnesis and nursing care. Likewise, different IT-mediated activities may be dependent on the outcome of related systems to achieve higher-level outcomes (Allen et al. 2011; Karanasios and Allen 2013). Among others, clinical decision making, accounting, and research activities require digital data about patients and treatments to produce outcomes that contribute to organizational goals such as increased efficiency and improved quality of care. These complex interrelations between multiple organizational activity systems imply that changes to an activity system may not only effect IT utilization in this system, but also the possibilities for goal-oriented actions that other systems create.

Following these arguments, it is theorized that OBITA processes need to aim at adapting activity systems such that they foster IT utilization behaviors that are associated with achieving intended outcomes at multiple levels. First, IT-related change processes need to ensure that affected activity systems support IT-mediated actions associated with intended concrete outcomes. Second, these processes need lead to actor-environment systems that facilitate consistent realization of these potentials of IT by all members to the required extent. Third, these processes need to ensure that interrelated organizational activity systems produce well-aligned concrete outcomes that serve longer term organizational goals. Before paths for effective IT-related change are discussed, a closer look at adaptation processes of interrelated activity systems is taken.

5.1.5.3 Co-Evolution of Activity Systems and Adaptive Tensions

The interrelations of actor-environment systems within organizations can be conceived of as the interplay between complex adaptive systems, where changes in one system effects the structure and/or behavior of other systems (Benbya and McKelvey 2006). Prior research shows that a series of adjustments at multiple levels can lead to sustained alignment (Benbya and McKelvey 2006; Vessey and Ward 2013). Sustainable alignment occurs when the interrelated complex adaptive systems mutually adapt so that they support the organization in its efforts to meet its goals (Vessey and Ward 2013). Complexity theory refers to these processes as co-evolution (Kauffman 1993; Simon 1996).

According to complexity theory, these processes can be fostered by matching co-evolutionary change rates of complex adaptive systems, facilitating self-organization of these systems and introducing adaptive tensions (Benbya and McKelvey 2006). Matching co-evolutionary change rates is concerned with the genetic variance within an organization. It is argued that firms are limited if they draw on homogeneous, relatively fixed capabilities. The more heterogeneous a firm's capabilities are, the quicker a firm can learn new things, deal with changes in the environment and improve their ability to adapt (Benbya and McKelvey 2006). This argument is well aligned with the findings of this dissertation concerning the role of social capital. Structural, relational, and cognitive linkages are "flexible conduits for the sharing and exchange of knowledge" that act "as a facilitator to strengthen how human capital is leveraged in organizations" (Subramaniam and Youndt 2005, p. 452). As such, these linkages determine a firm's capabilities to exploit existing knowledge and explore new knowledge that enables it to adapt business and IT structures and processes to changes in its environment (i.e., shared understanding). Likewise, modular enterprise architectures enable firms to implement change that match the rate of change in the environment (Vessey and Ward 2013). In addition, self-organization is facilitated by the increasing use of adaptive structures, methods, tools, and techniques in IS projects. Using a combination of traditional and adaptive (agile) methods in IS projects safeguards exploitation of existing resources and exploration of ways to adapt IS to changes in the environment. Moreover, it is argued that co-evolution is instigated by adaptive tensions imposed on interactions among overlapping perspectives. These tensions indicate changes that complex adaptive systems must address if they are to remain effective (Benbya and McKelvey 2006).

Though prior research drawing on complexity theory sheds some light on the dynamics of IT-related change processes, some limitations need to be addressed. First, the structure of complex adaptive systems that determines its behavior remains largely unexplored (Benbya and McKelvey 2006). Second, this research stream primarily focuses on the characteristics of IT that are critical to the adaption process (Vessey and Ward 2013). Third, though it is argued that alignment at any level "is better enabled if managers bring tensions to bear as a means of sparking coevolutionary dynamics" (Benbya and McKelvey 2006, p. 293), these tensions are not further elucidated.

The theory developed here aims to approach these limitations. As shown, the concept of activity systems enables us to describe and analyze the structure of complex adaptive systems within organizations and their mutual interplay. Viewing organizations as a complex network of interacting activity systems captures both technological and social aspects of OBITA, which are usually analyzed separately (see Section 2.2.2). Augmenting AT and

technology affordance theory allows factors of the systems beyond IT to be identified that may need to be adapted if the systems are to remain effective. Moreover, AT provides an analytical concept to identify, describe, and analyze adaptive tensions. AT posits that tensions within and between activity systems are the manifestation of contradictions (Engeström and Sannino 2011), which refer to problematic relationships between elements of activity systems. In general, contradictions refer to anything within the system that opposes the overall motive of the system, that is the outcome that actors of these systems are individually or collectively striving toward (Allen et al. 2013a). More precisely, contradictions refer to “a misfit within elements, between them, between different activities, or between different developmental phases of a single activity ... [which] manifest themselves as problems, ruptures, breakdowns, and clashes” (Kuutti 1996, p. 34). For an in-depth discussion of the causes and nature of contradictions within and between activity systems please see Paper V, Paper VI, Paper VII, and Paper VIII as well as Section 5.1.1 and Section 5.1.2 of this paper.

AT conceives of contradiction as the engine of change in collective activities (Allen et al. 2013a), in which “equilibrium is an exception and tensions, disturbances and local innovations are the rule” (Cole and Engeström 1993, p. 8). Contradictions and tensions make for an important part of change processes in which new balances are achieved and elements of collective activities are (re)produced and refined (Engeström 1987). They not only expose the dynamics of collective activities and inefficiencies, but also highlight opportunities for change (Allen et al. 2013a). If contradictions are aggravated within collective activities, actors may begin to engage in change efforts aimed to increase their ability to realize intended outcomes (i.e., trigger OBITA processes such as IT implementation and change projects).

These considerations lead to following theoretical assumptions that enhance the understanding of IT-related change processes aimed to improve OBITA (for preliminary empirical evidence see Paper III). First, as they generate tensions that destabilize collective organizational activities and cause inefficiencies (Engeström 1987), IT-related contradictions limit the emergence of potentials for organizational behaviors associated with achieving concrete outcomes IT bestows. Second, contradictions negatively impact the consistency and extent to which individuals realize the affordances of IT that contribute to outcomes at organizational levels. Third, IT-related contradictions within and between activity systems affect the alignment of IT affordance realization, that is the degree to which IT utilization behaviors at multiple levels support achieving longer-term organizational goals. If activity systems produce outcomes that are hardly aligned, the achievement of these goals is inhibited. Figure 15 summarizes these coherences.

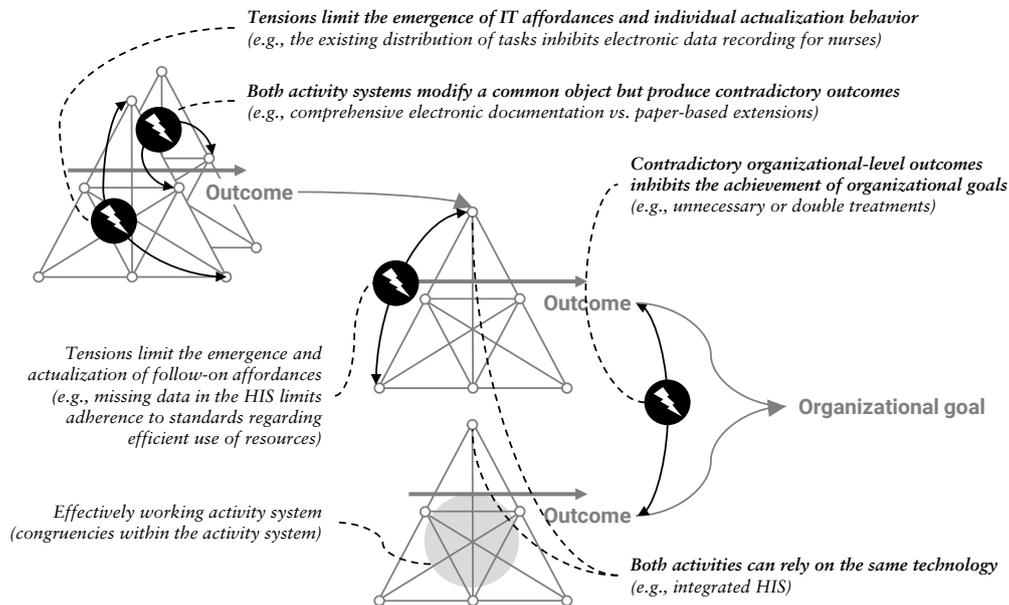


Figure 15: Role of contradictions within and between interrelated activity systems

5.1.5.4 Resolving Contradictions and IT-Related Change

Following the arguments outlined above, it is theorized that IT-related contradictions and tensions point to misalignments within and between interrelated actor-environment systems that can be attributed to social aspects (e.g., the interplay between actors within and between activity systems involving both business and IT professionals) and/or technical aspects (e.g., the functional properties of IT that limit the achievement of concrete outcomes). To improve organizational performance, these need to be iteratively approached by OBITA processes.

On the contrary, the absence of IT-related contradictions indicates a reasonable level of alignment, which Allen et al. (2013b) refers to as congruencies within and between activity systems. These congruencies are reflected by effectively working actor-environment systems that enable the achievement of higher-level organizational goals (for empirical evidence see Paper III, Paper VII and Paper IX). Thus, it is argued that co-evolutionary OBITA processes must lead to deliberated adaptations of activity systems such that contradictions are transformed into congruencies.

Concerning IT-related contradictions in healthcare, a key theme concerns the properties of HIS that contradict social structures that developed over time. The term social structure used here is borrowed from structuration theory. Structuration theory views social structure as the properties of rules and resources that allow “the ‘binding’ of time-space in social systems” (Giddens 1984, p. 17). According to structuration theory, moreover, social structure “exists only in the virtue of the activities they govern” and constitutes places, functions, rules, tasks, duties, and decision rights of these activities (Bhaskar 1978, p. 48).

This dissertation shows that IT may incorporate structures (e.g., roles, reporting hierarchies and standard operating procedures), which contradict traces of social structures that characterize existing actor-environment systems. This is particularly evident in healthcare settings, where social structures need to balance the need for orderly routines and the need

for sensitivity to variation in local conditions. The need for variation stems from the diversity of healthcare providers with differing professional roles, training, and experience; patients with differing characteristics, conditions, and medications; and a variety of different medical procedures and treatments (Fichman et al. 2011). Among others, these differences induce diversity in the use of the instruments available within similar activities and/or related activities (Oborn et al. 2011). As shown above, this diversity does not only create tensions with the need for orderly routines, it also contradicts the achievement of outcomes typically associated with HIS-related change (e.g., standardization) and related organizational goals (e.g., improved patient safety). Thus, effective OBITA processes require learning to determine the best way to adapt HIS and existing social structures that characterize multiple activities as well as to harmonize the capabilities HIS affords and the desired IT utilization patterns. Otherwise, healthcare professionals may develop workarounds that restore congruencies within their activity systems, but inhibit the realization of intended outcomes (see Paper III, Paper V, Paper VII, and Paper VIII).

Overall, the theory developed here argues that effective OBITA processes require co-evolution of multiple complex adaptive systems involving IT and the social elements of the actor-environment systems (i.e., motives, rules, and the division of labor). To spark co-evolutionary processes along a variety of IT-mediated organizational activities and enable the achievement of (changing) organizational goals, OBITA processes must facilitate the identification of organizational activity systems that are affected by these processes as well as contradictions within and between them (Paper III, Paper VI, Paper VII, Paper VIII, and Paper IX). OBITA processes also need to identify and approach those contradictions that impede IT utilization behavior. These processes may facilitate needed change to IT and social structures. For instance, individuals could be incentivized to utilize a new IS in a way that enables them to achieve concrete outcomes at individual and organizational levels (i.e., consistently and to the required extent). Achieving intended outcomes by utilizing the IS may cause them to reflect traces of pre-existing structures and the strands of history they carry (i.e., positive feedback). As individuals begin to engage in collective change efforts aimed at adapting IT and other elements of their actor-environment system, these feedback processes may eventually foster self-organization of these systems (Allen and Varga 2006). As these adaptations may affect other activities, they might trigger co-evolutionary processes that span multiple activity systems.

Following Vessey and Ward (2013), adaptive IS management facilitates such co-evolutionary processes. In adaptive IS management, many actors from across organizational boundaries collaborate to identify problems, resolve them, and foster behavior that supports compliance with changing organizational goals. As shown in Paper VIII and argued above, the success of change efforts that follow an adaptive IS management approach is contingent on shared understanding about the network of affected activity systems (see also Section 5.1.4).

5.1.5.5 Paths for OBITA Processes

As shown, sustainable OBITA may require mutual changes to IT and other elements of organizational actor-environment systems that consider effects in related systems. Moreover, it is assumed that OBITA processes should approach emerging tensions on a regular basis by implementing incremental changes (Vessey and Ward 2013). Such changes are expected to drastically reduce, if not eliminate, the need for revolutionary change and significantly

decrease the chance for serious misalignments. Though it is argued that alignment does not follow a deterministic process, viewing organizations as a network of interrelated activity systems that produce possibilities for action associated with achieving organizational goals helps to identify paths for successful OBITA processes. Below it is outlined how these paths can be identified.

First, an organization needs to be aware of the goals it wants to accomplish. Typically, these goals are fixed at the strategic level. Second, the concrete outcomes that contribute to this goal as well as the IT-mediated activities that produce these outcomes at the operational level should be identified. Third, the hierarchical interrelations between individual-level actions, organizational-level outcomes and long-term organizational goals should be broken down (for a simplified example see Figure 15). Fourth, the activity systems that govern IT-mediated actions and interactions of individuals that contribute to the intended outcomes should be decomposed, interrelations analyzed and existing contradictions and tensions identified. Fifth, it should be analyzed how the contradictions within or between the activity systems limit the emergence and/or realization of potentials for individual-level and organizational-level behaviors that, if realized consistently and to the required extent, contribute to the achievement of intended concrete outcomes.

Using scenario-techniques, for instance, promising paths for adapting the elements of the activity systems can then be derived and OBITA processes such as IS implementation projects, IS change projects or business process reengineering activities planned. In this regard, this dissertation extends prior literature as it provides theoretical arguments concerning the paths to follow. More precisely, the theory developed here proposes starting with deliberately inducing changes to contradictory activity systems that enable or constrain individual-level and/or organizational-level behavior associated with achieving concrete outcomes that contribute to the achievement of follow-on, more-advanced outcomes. These changes should create the potential for behaviors associated with achieving these goals and facilitate their realization. However, organizations should not unintentionally produce new contradictions or amplify existing tensions in the network of interrelated activity systems that do not contribute to co-evolutionary processes. Ultimately, resolving contradictions and enabling organizational actors to achieve concrete outcomes should induce bottom-up adaptive change processes (e.g., incremental changes to the division of labor) and thus spark sustained co-evolution of activity systems.

In line with Vessey and Ward (2013) and Wagner and Weitzel (2012), the theory developed here acknowledges that OBITA processes may include both top-down, formal processes (i.e., major planned change alignment path) and bottom-up emergent processes (unplanned change). Both processes are dependent on strong social capital (see Section 5.1.3). However, the empirical evidence of the papers in this dissertation reveals that, at least in 'decoupled' organizations like hospitals, bottom-up processes (e.g., reflection of existing social structures) need often to be induced by deliberated top-down processes (e.g., IS implementation projects). As the future of activity systems can hardly be predicted and their history is irreversible, OBITA processes need to be continually monitored and knowledge about the activity systems and how changes affect these must be shared and integrated (see Section 5.1.4). In this regard, the activity theoretical analysis outlined here makes it possible to monitor whether co-evolutionary processes are sparked, if contradictions and tensions are

resolved, if organizational actors are enabled to realize necessary concrete outcomes, and, ultimately, if organizations can achieve their goals.

5.1.5.6 Summary of Contributions

The process theory developed here sheds light on how OBITA emerges in organizations. It decomposes an organization's operations into goals, organizational-level and individual-level outcomes of collective activities, and the actor-environment system involving IT and complementary socio-organizational resources that enable or limit the potential for behavior to achieve these outcomes. By analyzing the elements and their interrelations, alignment journeys can be theoretically described and thus anticipated, planned and monitored. Conceiving organizations as a complex network of activity systems allows contradictions between HIS and social structures to be identified and analyzed that may not come into view when modelling organizational operations as complex process chains. Using activity systems as an analytical device raises awareness of the contested nature of healthcare activities and facilitates the analysis of multiple mediating relationships that cannot be considered in isolation. Moreover, activity systems driven analysis generates awareness for the situated and provisional nature of healthcare activities, which requires consideration of different developmental states and traces of history and local specifics.

The theory also extends the affordance theory on IT-related organizational change by introducing the notion of activity systems as affordance-generation systems and contradictions as inhibitors of affordance realization (Strong et al. 2014). Extending and applying the affordance theory enhances knowledge about multi-level effects of IT-related change (i.e., individual-level and organizational-level IT utilization behaviors in operational-level activities, related outcomes, and higher-level organizational goals). As such, the theory substantiates the rather abstract multi-level approach on alignment as proposed by Benbya and McKelvey (2006). As argued above, AT's notion of contradictions also extends prior work on OBITA using the complexity worldview by providing a theoretically grounded analytical instrument to identify tensions, that, if approached effectively, may set in motion self-organized co-evolutionary processes (Benbya and McKelvey 2006; Vessey and Ward 2013). The main theoretical contributions to the knowledge of OBITA processes are summarized in Table 21.

Table 21: Summary of contributions to the knowledge of OBITA processes

Past research	Contribution
Sustainable alignment results when an organization's complex adaptive systems co-evolve and allow for achieving constantly-changing organization's goals. Adaptive tensions between an organization's complex adaptive systems set in motion dynamic, multi-faceted, and non-deterministic alignment processes. Complex adaptive systems and adaptive tensions are not further illuminated.	Organizational complex adaptive systems can be conceptualized as multiple interrelated activity systems that co-evolve over time. AT substantiates the constituents of these systems. Contradictions and tensions reveal insufficient integration of IT and socio-organizational complexities and, if identified and addressed, drive transformation processes within and between these systems.

Past research	Contribution
<p>OBITA aims at improving organizational performance. The contribution of IT to organizational performance is dependent on IT utilization, that is the realization of affordances IT creates. Theories about how/why/when IT affordances are realized by individuals or groups of individuals need to be developed.</p>	<p>Contradictions and tensions within and between activity systems (including different developmental states of activity systems) explain how and why affordances are not/inconsistently realized at individual and organizational levels and why performance improvements could not be achieved. This implies that OBITA processes need to identify the contradictions and tensions that limit realization of IT affordances and resolve or mitigate them. Moreover, organizations should be careful not to create new contradictions or amplify existing tensions unintentionally.</p>
<p>It is theorized that there are different paths to improving integration between IT and socio-organizational complementarities.</p>	<p>Linking IT affordances, concrete immediate outcomes of realizing affordances, the activity systems that effect IT affordance realization, and related organizational goals enables the identification of expedient paths for OBITA processes.</p>

5.2 Implications for Practice

Summarizing and synthesizing the managerial implications of the papers included in this dissertation, this section offers guidance for practitioners engaged in OBITA processes. The insights are structured along two phases: analyzing and planning necessary adaptations to business and IT structures and processes and implementing these.

5.2.1 Analyzing and Planning HIS-Related Changes

This dissertation demonstrates that integrating HIS and medical reality requires practitioners to develop sufficient and actionable understanding of the activities that are affected by HIS. In line with prior research, it is shown that applying concepts offered by AT facilitates understanding of an HIS-mediated activity, how it changes over time, and its interaction with other activities (Engeström 1987; Engeström 1999; Engeström 2001). When concerned with OBITA processes such as HIS implementation and change, practitioners are thus advised to integrate the analytical tools AT offers into their activities as outlined below.

First, as our findings indicate that awareness of the collective activity systems that are affected by OBITA processes increases chance for successful integration of HIS and medical reality (Paper VII and Paper VIII), short-sightedness of actors considering IS often only as enabling them to approach their individual goals more effectively needs to be overcome. This dissertation shows that considering the acting persons is necessary but not sufficient. In this regard, measures as proposed by prior research such as stakeholder analysis, getting buy-in from users, and having a project champion can facilitate the design of IS that are perceived as efficient mediators between individuals and their objectives (Boonstra et al. 2008; Dwivedi et al. 2014). However, Paper VIII shows that these measures do not ensure that IS

implementation will lead to a workable system on the collective level that enables the achievement of joint outcomes. Rather, this dissertation shows that practitioners are well-advised to consider the level the collective nature of HIS-mediated work activities and to analyze all components of the underlying activity systems, their interrelations, the network of activities they are embedded in, and the role of the affected instruments within these complexities (e.g., the legacy tool or the HIS that should be adapted).

Such an analysis could start with the identification of all actions that are relevant for a collective activity and of the means that enable or constrain these actions (i.e., instruments, rules, division of labor). Using activity systems as the prime unit of analysis that frames these components will most-likely enable practitioners to identify critical nexuses (see also Section 5.1.5.5). Moreover, the questions listed in Table 21 may help to identify important HIS-related characteristics of the activity systems. These can then be structured and described using activity systems diagrams.

Table 22: *Questions to identify HIS-related characteristics of the activity systems.*

Characteristics	Questions that illuminate these complexities
<i>Contested</i> nature of healthcare activities (subject-community-object relationships)	Which perspectives on the object of activities concerned with healthcare delivery coexist? (How) does HIS need to account for the different perspectives? Does it over-emphasize a single perspective? Does the HIS reinforce contradictions between divergent perspectives? Does the HIS limit other members of the activity system in achieving their intended concrete outcomes, particularly those related to less visible aspects of the object?
Healthcare activities involve multiple <i>mediating</i> relationships (instruments, rules, division of labor) that cannot be considered in isolation	Which tensions need to be resolved or mitigated prior to HIS implementation? What are important conventions and tools that mediate interests, traditions, actions and interactions of individuals and communities? How do they interrelate? (How) will these mechanisms be affected by HIS? (How) do they affect the potentials of HIS for behavior associated with achieving concrete outcomes at individual and organizational levels?
Healthcare activities are <i>situated</i> , traces from history and local specifics must be considered	Are there conventions that reflect the history of the activity? Do these conventions contradict current developments? (How) will HIS interact with these historically evolved and emergent conventions? Does HIS account for local variations of the activity, particularly regarding the rules/norms and differences in the way tasks are distributed?
Healthcare activities are often <i>provisional</i>	Is HIS able to resolve or mitigate tensions that developed over time? (How) is the HIS able to deal with ambiguity of actions and interactions of various actors?

Second, practitioners need to bear in mind that a crucial step in learning about an activity is to participate in that activity (Greig et al. 2012). Thus, enhancing understanding of the activities and their complexities may require IT professionals to occasionally participate in activities that are or may be affected by the OBITA processes. That way, IT professionals can identify local and temporal variations to the scripted course of action and gain a deeper understanding of the role of the HIS plays in these variations.

Third, practitioners should analyze the activity systems to identify contradictions that may generate the inefficiencies and misalignments they intend to solve. As Paper VII shows, the inefficiencies and misalignments OBITA processes tackle can frequently not be resolved easily by implementing a new or adapting an existent HIS (see Paper VII). Rather, (additional) changes to other components of the activity system are required. Thus, practitioners are advised to reconsider which adaptations to the activity system are necessary to resolve the contradictions that emerge as misalignments and inefficiencies and, if necessary, adapt the object of OBITA processes accordingly. In this regard, the findings of Paper III emphasize that evolved conventions that govern collective healthcare activities need to be aligned with the possibilities for action HIS offer. Effective OBITA could thus require introducing incentives that stipulate meaningful use of HIS. Moreover, integration of HIS and medical reality could be facilitated by informing healthcare professionals about the value of data, both from a medical and business point of view. Thus, incorporating managerial aspects of healthcare delivery and HIS usage into the curriculum and incentivizing professionals to attend corresponding in-house education programs could facilitate OBITA outcomes.

Forth, the findings of this dissertation imply that practitioners should imagine how the new or adapted HIS needs to be designed and functioning to resolve the inefficiencies and misalignments without unintentionally provoking new contradictions or tensions. Here, too, involved actors may use the results of the activity system analysis to discuss how the HIS will become a legitimate and supportive part of the activity system. Practitioners may create scenarios using techniques like “expansive visibilization” (Engeström 1999) that enable them to anticipate how the new or adapted HIS will interact with other elements of the activity, particularly how it will impact their actions and interactions with other members of the activity system. This decrease the likelihood of the emergence of other, unintended misalignments (see Paper VIII).

Though prior research shows that applying activity theoretical concepts is generally appropriate in day-to-day activities of IS practitioners, Korpela et al. (2000) makes some suggestions: First, when introducing AT to novices, the conceptual schema must be illustrated by well worked-out real-life examples. The cases analyzed in Paper VII and Paper VIII offer some real-world examples that might be used in practice. Second, analyzing somebody else’s activities was found to be difficult. Though Korpela et al. (2000) concludes that an IT professional with some training in activity analysis should be able to guide the analytical process, the findings of this dissertation emphasize the need to involve experts in the activity under consideration.

Overall, the insights offered by this dissertation may help to enhance established requirements engineering methods that enable analysts to understand critical requirements. These methods have a strong focus on individual perspectives on the goal of IS implementation, difficulties and constraints, relevant tasks as well as on information needed (Pitts and Browne 2007), but do not emphasize the collective nature of IS-mediated activity. The implications presented

above will hopefully help practitioners to improve these techniques, to identify critical aspects of the collective activities affected by OBITA processes in practice, and eventually improve integration of HIS and medical structures and processes.

5.2.2 Implementing HIS-related Changes

The findings of this dissertation show that efficient OBITA processes require mutual adaptations to both the IS and related components of the activity system. These adaptations often need to be implemented gradually by means of minor change projects, business process reengineering initiatives and adaptations to less tangible structures that govern healthcare work (Paper III and Paper VIII). Moreover, the cases discussed in Paper V and Paper VIII show that implementing HIS following a “big bang” methodology bears the risk that new contradictions arise or existing tensions are amplified. Thus, this dissertation supports Heeks (2006) notion that traditional, highly structured and sequential development methodologies are not well-suited for the complexities of the healthcare domain.

As some HIS-related characteristics of collective activities may only emerge when changes are introduced, utilizing iterative implementation methods and putting users in touch with the HIS at the earliest opportunity may help make explicit what is usually taken for granted. Thus, practitioners are encouraged to develop and implement strategies that make everyday practices transparent. To achieve this goal, practitioners might employ strategies such as cooperative prototyping, in which a future IT artifact is designed in part cooperatively by designers, prospective users and stakeholders (Mogensen 1992). Joint work on these prototypes may raise issues and shift questions from subject-object interactions towards the wider context of the activity. Moreover, implementation strategies should not avoid conflicts but rather make use of or even provoke constructive conflicts to raise knowledge about healthcare activities that is deeply embedded and socialized in practice and hence difficult to elicit (Paper VIII). Constructive conflicts may foster actors to deal with differences in their perspectives on the collective activity system and, ultimately, contribute to the development of a shared understanding on their joint activity and the role of the HIS within.

In line with this argument, the theoretical reflections on IT-related change imply that, on the way to achieve sustainable alignment, OBITA processes should approach emerging tensions on a regular basis by implementing incremental changes. Such changes are expected to drastically reduce the need for revolutionary change and significantly decrease the chance for serious misalignments in the long run. Section 5.1.5.5 points out how change paths can be identified using activity system networks. These findings may motivate practitioners to analyze organizational activity system networks and to use scenario techniques and related methods to anticipate co-evolution within these networks. Based on such analyses, areas where change needs to be consciously introduced to stimulate and drive co-evolution can be identified.

In addition, the findings advise practitioners to strengthen social capital between IT and medical professionals. Paper IV and Paper V indicate that structural linkages offered by meetings between IT and medical professionals are important to facilitate OBITA processes in decoupled organizations. However, practitioners should keep in mind that social interactions in these meetings should allow for the development of shared representations, interpretations, and systems of meaning as well as trust and a common identity. In this regard, particularly project managers need to consider differences in cognitive abilities,

existing power relationships, and horizontal specialization. Findings indicate that they are well advised to establish measures that ensure that all occupational groups are involved, develop relational and cognitive linkages, and eventually perceive the benefits of the changes as outweighing the challenges they will face. Moreover, practitioners are well-advised to monitor social capital along the complete lifecycle of the change project and to be aware that misaligned project deliverables may significantly impact social capital. Without heedful interventions, these effects mutually reinforce each other and ultimately obstruct OBITA processes.

Finally, practitioners need to consider the ability of stakeholders to integrate their idiosyncratic knowledge. In this regard, this dissertation not only emphasizes the cognitive dimensions of social capital, it also highlights the importance of the artefacts employed within social interactions (Paper V and Paper VI). These artefacts have the capacity to enable or obstruct actors' access to knowledge that is socially embedded and invested in practice. To make knowledge about activities accessible for all actors involved in OBITA processes and thus facilitate the development of shared understanding, practitioners need to ensure that the artefacts employed (e.g., requirements specifications) enable all stakeholders to experience or imagine how changes will affect other elements of the activity systems. Again, this research emphasizes the value of prototypes and practices like cooperative prototyping, where the artefact becomes over time a legitimate part of the activities. Developing and implementing changes by means of agile methods iteratively, for instance, is expected to facilitate the translation of knowledge of the key elements of affected activity systems and thus OBITA processes.

Overall, the results of this dissertation indicate that it is worthwhile to blur the boundaries of the organizational silos by means of strengthening structural, relational, and cognitive social capital and shared understanding. Both will enhance cross-functional cooperation between IT and medical stakeholders as well as cooperation between the different medical occupational groups and disciplines during HIS-related change, which is an indispensable presupposition for increasing OBITA and realizing the potential of HIS. The theoretical and empirical evidence this dissertation provides indicates that without strong social capital and profound understanding of the organizational activity systems and the (future) role of HIS within, co-evolutionary change processes and thus sustainable alignment will most likely be not achieved.

5.3 Limitations

While this multi-method thesis offers several contributions to theory and practice, as with any empirical research it comes attached with some limitations. The most notable overarching limitations are discussed below, more specific limitations can be found in the individual papers.

First, the structured review of OBITA included in this paper only focused on papers published in top journals and conferences (Lowry et al. 2013) within a limited timeframe. Although a forward and backward search was conducted (Webster and Watson 2002), it cannot be ruled out that relevant articles were not considered. Moreover, the search strategy filters papers that use one of the defined search terms in the title, abstract, or author-supplied keywords.

Although the terms are common to alignment research and involve several synonyms, the search may exclude papers that are concerned with alignment processes such as business process reengineering as well as IS implementation change. However, again, forward and backward search was expected to mitigate this effect and reveal the most relevant papers dealing with OBITA.

Second, the timeframe for collecting empirical data on the cases was limited. In some cases, the researchers were only able to collect data about the early phases of the changes retrospectively (e.g., Case E, Case M, and Case T). In other cases, the effects of OBITA processes such as additional contradictions or (temporary) stabilization of the activity systems may have not totally emerged during the time span of data collection. Therefore, our analysis may miss effects associated with the OBITA processes.

Third, qualitative and quantitative data was primarily collected in German hospitals and mainly covers OBITA processes concerned with the shift from paper-based to electronically documentation and the utilization of patient and treatment data (i.e., digital transformation of healthcare). On the one hand, similar contextual features improve comparability of the findings, which, in turn, increases confidence in the significance of the theoretical statements. On the other hand, the research design limits the potential for generalization from empirical findings to theoretical statements that apply for a larger population (Lee and Baskerville 2003). The conclusions are thus rather seen as comprehensive explanations of particular phenomena in specific settings that are (a) generalizable to the theoretical propositions derived from prior literature and that (b) may be valuable in future in other organizations and contexts (Lee and Baskerville 2003; Yin 2009). Consequently, theoretical perspectives developed in this dissertation to explain OBITA processes and outcomes need to demonstrate their empirical validity in other settings (Lee and Baskerville 2003).

Fourth, many of the contributions highlighted here relate to theoretical concepts of AT. Prior research, particularly in psychology and philosophy, discuss the difficulties of putting AT into concrete empirical research practice (Josephs 1996) and question its predictive power (Bakhurst 2009). The issues discussed there were found to be attributed to the possibility for varied interpretations of what an activity is (Bakhurst 2009), a lack of empirically testable constructs and statements (Josephs 1996), and the ambiguity of the concept of contradictions (Bakhurst 2009; Peim 2009), among others. Acknowledging these difficulties and limitations, AT can thus only be viewed as a mid-range theory, which provides an appropriate theoretical framework that enables analysis of organizational change by revealing the structure of the phenomenon (Allen et al. 2013a; Bakhurst 2009). To deal with these limitations, theories that have already been proven to be applicable for empirical research were augmented with the theoretical concepts offered by AT (e.g., shared cognition, affordance theory, complexity theory, etc.). However, drawing on relations that the components of activity systems bear to one another and focusing on contradictions involves the risk that other reasons for change are not identified.

5.4 Future Research Opportunities

The results and implications of this dissertation provide new insights into OBITA processes in general and more particularly for multidisciplinary, professionally-driven, and highly

hierarchically structured settings like hospitals. Though, the contributions and limitations of this dissertation open several avenues for researchers to enhance understanding in this field. Future research may draw on the conceptualization and nomological network of OBITA developed here as well as on the theoretical and empirical findings of the papers included in this dissertation. Such research may yield additional insights that may shed even more light onto the processes and outcomes of OBITA in healthcare and beyond. The most promising avenues for further research are illustrated in the following.

The findings concerning the relationship between types of social capital (i.e., structural, relational, and cognitive), immediate knowledge integration outcomes (i.e., shared understanding), and mediate OBITA outcomes (i.e., misalignments between the HIS and medical structures and processes) opens an interesting field for further research. Though the influence of social capital on knowledge integration is mostly studied as one-way effect (Rouse and Morris 1986), Paper V provides empirical evidence that the effect of social capital on knowledge integration processes is not unidirectional. Further longitudinal studies are needed to analyze these effect in greater detail, particularly how reciprocal effects between social capital in HIS implementation and change projects and their outcomes co-evolve. Moreover, further research could focus on the interrelations of the types of social capital and how changing configurations influence OBITA processes and outcomes. Such studies could provide further evidence that social capital between IT and medical stakeholders – depending on the characteristics of its dimensions and the requirements of various stages of IT-related change initiatives – comes with benefits and risks, as already indicated by Adler and Kwon (2002). Insights into the task-dependencies and effects of social capital in various stages of IT-related change initiatives could offer valuable implications for theory and practice.

Another avenue for further research is to analyze how existing IS implementation methods including requirements engineering approaches could be enhanced. As this research indicates, critical aspects of activities that need to be adapted during OBITA processes are difficult to elicit as they are deeply embedded and socialized in practice. Hereof, it is assumed that iterative implementation methods, tight cooperation between IT and business professionals, and early interaction with prototypes may help to make explicit that which is usually taken for granted (Mogensen 1992). Moreover, this research shows that analyzing the affected activity systems including their cultural-historical pathways may sensitize involved actors to HIS-related issues they would not otherwise be aware of. Building on these insights, further design-oriented research could develop methods and tools informed by activity-theory that complement approved implementation and change methods and evaluate their utility.

In line with this suggestion, further research may also analyze if and how the frameworks developed in Paper VII and Paper VIII support the process identification and discovery phase of the business process management lifecycle (Recker and Mendling 2015). Such studies may take an action research approach (Mansell 1991), refine the framework and evaluate its utility for the identification of local and temporal variations to the scripted course of action and the development of shared understanding about the role of the HIS within these variations. Insights gained by such research may significantly facilitate HIS implementation and business process redesign in hospitals. In addition, such research could develop methods and tools that support the documentation and modelling of critical aspects of IS-mediated organizational activities. This, in turn, may decrease dependency on the development of shared understanding and facilitate the identification of best practice approaches such as

configurable process models and HIS configuration patterns (Dreiling et al. 2006). Moreover, such research may show that process documentation does not only influence the relationships with external IT providers but also the flexibility of internal IT units (Martin et al. 2008).

As with the papers included in this dissertation, most research utilizing AT relies on qualitative research methods (e.g., Allen et al. 2011; Allen et al. 2013a; Karanasios and Allen 2013; Karanasios and Allen 2014; Rui Chen et al. 2013). Further research may refine the concepts identified in this research, develop quantitative measures, and analyze their effect on existing constructs reflecting the outcome of OBITA processes. For instance, further research may test to what extent the emergence of the types of contradictions as identified in Paper III, Paper VII, and Paper VIII relate to HIS usage patterns, as, for instance, reflected by usage effectiveness, efficiency, adaptation, and learning as proposed by Burton-Jones and Grange (2013). Moreover, scholars may develop quantitative measures to test the extent to which shared understanding about critical areas of the activity system explains outcomes of OBITA processes such as the emergence of unintended consequences. Such studies would not only provide further evidence for the explanatory power of the theoretical concepts derived from AT, it would also enable practitioners to identify areas that should be approached by OBITA processes and to predict the success of such IT-related change efforts.

Another area for further research is the refinement of the activity-theoretical perspective on affordances. Paper III shows that activity systems as theoretical device enables research to analyze the structure of actor-environment systems that, on the one hand, frame social actions and, on the other hand, are reproduced and altered by these actions (Engeström 1987; Orlikowski 1992). More particularly, this research shows that analyzing contradictions within these systems provides explanations for divergent IT utilization behaviors in organizations, both on the individual and the collective level. Future research could draw on the types of contradictions identified in Paper III and more deeply investigate the relation between these contradictions and the consistency, extent and alignment of individual IT utilization behaviors at different levels (Strong et al. 2014). Analyzing the dependencies among several types of contradictions and diverse types of IT utilization behaviors provides opportunities for further developing the theoretical lens on IT affordances. Moreover, studies are also needed to analyze if and how the activity-theoretical perspective on affordances applies to other technologies in other domains. Such studies would contribute to our understanding of the nature and effects of IT-related misalignments at the operational level, particularly to the extent to which they are about IT and its design (e.g., a lack of flexibility), about organizations and actors (e.g., range of available capabilities), and about their relations (Benbya and McKelvey 2006).

Most of the papers included in this research focuses on the integration of HIS and medical structures and processes in healthcare delivery. However, except for Paper IX, this dissertation does not explicitly consider the core processes and structures of the IT function in hospitals. Further research might address this limitation and analyze how IT delivery and change processes, structures of the IT function (e.g., centralization or decentralization), and IT governance mechanisms need to be adapted to enable the IT to adapt HIS to medical reality efficiently (e.g., by adopting approaches that facilitate iterative changes, rapid prototyping, and close cooperation between IT and medical professionals during the design and operation of HIS such as DevOps). Such research may draw on activity theories concept of multiple interrelated activity systems (activity networks) (Engeström 1987) and resolution

of contradictions as a means of sparking co-evolutionary processes. Studying the interrelation between IT and business activities, analyzing their co-evolution over time, and identifying hierarchies of interaction may reveal important insights concerning the optimal design of IT units or teams as well as efficient IS implementation strategies in complex, multi-hierarchical, bureaucratic and professional organizations like hospitals.

6 CONCLUSION

The main objective of this dissertation is to deepen scholars' and practitioners' understanding of IT-related change in healthcare at the operational level. Building on and extending prior research on OBITA, the studies spanning this thesis aim to provide empirical and theoretical evidence that enables practitioners to align IT and medical reality to realize expected potentials of IT in healthcare. The results posit that strong social capital mitigates the challenges that come with structurally decoupled organizations and facilitates identification and implementation of necessary IT-related change in hospitals. Likewise, shared understanding about how HIS will affect and is affected by socio-organizational complementarities is found to be a critical requirement for effective OBITA processes. Drawing on strong structural, relational and cognitive linkages between IT and medical professionals as well as sufficient shared understanding, effective OBITA processes approach reciprocal adaptations to HIS and other elements of interrelated organizational activity systems the HIS is embedded in. It is shown that, by iteratively resolving contradictions and/or mitigating tensions within and between activity systems, these adaptations increase the efficiency of HIS, may trigger co-evolutionary processes and thus lead to sustained alignment. To conclude, this dissertation extends prior theories on alignment, helping scholars understand and account for the unique and complex characteristics of the healthcare domain and offering actionable guidance for practice.

Overall, this study identifies effective OBITA processes as key for the digital transformation of healthcare and provides guidance to healthcare IT experts and medical professionals in facilitating these processes to fully realize the potential of IT.

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APPENDIX: ANNOTATED BIBLIOGRAPHY

The articles included in the literature review on OBITA are sorted chronologically

Chan (2002)

Theoretical basis	Not explicated
Method	Qualitative study (8 cases)
Research aim	Identification of the determinants of business-IT alignment that are most consistently present, identification of the degree to which strategic and structural (i.e., operational) business-IT alignment is important to the firms, and identification of other dimensions of business-IT alignment beyond strategic and operational dimensions.
Findings/contributions	<p>The paper shows that structural (i.e., operational) business-IT alignment varies by organization and that there is no single right way to achieve structural alignment. Further research should strive out to identify other preconditions of structural alignment.</p> <p>The findings also demonstrate that flexibility of IS structure as well as informal organizational structures and bonds between line personnel and IT professionals are critical for business-IT alignment. The informal structure “interacts with, and transcends, formal organization structures and strategies” (Chan 2002, p. 109).</p>

Benbya and McKelvey (2006)

Theoretical basis	Complexity theory
Method	Conceptual paper
Research aim	Development of an integrated view of alignment at three levels of analysis (individual, operational, and strategic) that draws and builds on co-evolutionary theory
Findings/contributions	<p>This paper shows that the difficulty of alignment stems from its co-evolutionary and emergent nature. It is argued that alignment can be facilitated if the first principles of efficacious adaptation are kept in mind.</p> <p>Though enabling all dynamics in parallel is best, the following sequence is workable: inducing adaptive tensions, increasing the degrees of freedom in the form of IS and organizational abilities, managing the interaction between modularization and cost efficiency, speeding up knowledge acquisition, fostering deviation amplification by setting positive feedback loops in motion.</p>

Dreiling et al. (2006)

Theoretical basis	Not explicated
Method	Conceptual paper
Research aim	Proposition of generic enterprise system (ES) configuration patterns as methods to facilitate operational alignment.
Findings/contributions	<p>This paper offers a novel approach to improve alignment at the operational level (i.e., between ES and the needs of organizations) based on configurable process models: the use of extended business process models that guide the configuration process.</p> <p>Various configuration patterns and learnings on the challenge of deriving syntactically correct models are presented.</p>

Rivard et al. (2006)

Theoretical basis	Competitive strategy framework and resource-based view
Method	Quantitative study (n=96)
Research aim	Improving understanding of the contribution of IT to firm performance.
Findings/contributions	<p>The findings reveal that OBITA, indicated by IT support for firm assets, positively impacts a firm's profitability.</p> <p>It is shown that IT support for firm assets positively impacts a firm's IT support for its strategy. It is also indicated that IT's enhancement of the firm's core assets such as its organizational, marketing and technical competencies, indirectly effects a firm's market performance. This effect is mediated through the support of IT for a firm's strategy (e.g., by enabling the implementation of low cost strategies through e-business models).</p> <p>Overall, this paper reveals that OBITA aims at enhancing operational effectiveness (i.e., profitability), while strategic alignment directly aims at improving market performance.</p>

Bharadwaj et al. (2007)

Theoretical basis	Theory of coordination, resource-based view (complementarity resources)
Method	Quantitative study (n=216)
Research aim	Development of an integrated model of manufacturing performance that considers coordination between manufacturing and marketing, manufacturing and supply-chain, and manufacturing and IS.
Findings/contributions	<p>Closer collaborations between the IS and manufacturing functions is found to improve the firm's ability to provide integrated and consistent access to relevant information and to connect with the firm's customers and supply chain partners. As to that, coordination between IT and manufacturing “must extend well beyond the system implementation stage, and ongoing coordination between the two functions is critical for achieving more integrated information systems” (Bharadwaj et al. 2007, p. 449).</p> <p>Integrated IS capabilities provided by sophisticated IS enable other intra-organizational groups such as marketing, manufacturing and supply chain to share information and coordinate their activities. However, this effect only applies when there is a sufficient degree of coordination and shared commitment to mutual goals between these units.</p>

Martin et al. (2008)

Theoretical basis	Knowledge based theory, not further explained
Method	Quantitative study (n=73)
Research aim	Exploring the interplay of different indicators of OBITA (shared knowledge, communication, cognitive relationship) as well as the effect of IT provider flexibility and process documentation.
Findings/contributions	<p>The paper demonstrates that shared knowledge strongly influences IT provider flexibility and that IT provider flexibility influences cognitive relationship. The effect of communication on IT provider flexibility is mediated by shared knowledge.</p> <p>Moreover, process documentation was found to affect the interplay of the dimensions of operational business-IT alignment and IT provider flexibility.</p>

Lee et al. (2008)

Theoretical basis	Resource-based view
Method	Quantitative study (n=270)
Research aim	Employing a socio-technical alignment framework to explain how (internal) business-IT alignment could be accomplished in collaborative environments.
Findings/contributions	The paper indicates that business-IT alignment is a multidimensional concept that includes social and technical aspects. Both dimensions were found to directly impact IS effectiveness, which, in turn, was shown to impact business performance.

Tarafdar and Qrunfleh (2009)

Theoretical basis	Not explicated
Method	Qualitative study (4 cases)
Research aim	Analysis and identification of the critical aspects and processes associated with tactical (i.e., operational) business-IT alignment.
Findings/contributions	The paper contributes a characterization of strategic and tactical business-IT alignment, illustrate four types of alignment and propose alignment-related managerial actions appropriate for each type.

Boonstra et al. (2011)

Theoretical basis	Strategic alignment model (SAM)
Method	Qualitative study (2 cases)
Research aim	Development and test of a framework for the four domains of business-IT alignment (business strategy, IT strategy, business structure, and IT structure) with the value configuration models in service industries (value chain, value shop, and value network) by means of two telecare projects.
Findings/contributions	<p>The findings reveal that alignment in all four domains is most likely related to the success of telecare projects.</p> <p>Concerning operational (or structural) alignment, the findings indicate that finding a balance between the abilities of the IS, the role of telecare in the service encounter, and the IT skills of the business is critical. Moreover, there is evidence that OBITA is contingent on efficient personal relationships between the IT and business people.</p>

Wagner and Weitzel (2012)

Theoretical basis	Not explicated
Method	Qualitative study (single case; alignment project)
Research aim	Development and test of an operational business-IT framework (OperaA) encompassing three dimensions (knowledge, communication, and trust)
Findings/contributions	The paper contributes three alignment paths. Each path is anchored in a different dimension of the OperaA framework and involves different mechanisms to improve business processes and enable successful change: major planned change alignment path (focus on communication), steady state alignment path (focus on knowledge), and major unplanned change (focus on trust).

Burton-Jones et al. (2013)

Theoretical basis	Institutional theory, punctuated equilibrium theory, and complexity theory
Method	Conceptual paper
Research aim	Establishing a theoretical foundation for the process of business-IT alignment that describes how and why an organization's IT responds to business needs as the organization changes over time by resolving the tensions among three major organizational theories.
Findings/contributions	<p>This paper argues that institutional theory, punctuated equilibrium theory, and complexity theory assume that organizations tend towards maintenance of order through the structure that underlies the organization and its information system, that is, the relative stable set of core beliefs/values and basic rules/logic. If elements of this 'deep structure' change, adaptations occur.</p> <p>While institutional theory and complexity theory assume that organizations adapt continuously over time, punctuated equilibrium assumes that change is discontinuously as it only occurs after crises. Also, the rationales for stability and change differ between the theories. Institutional theory assumes that actors' behavior is mainly driven by legitimacy seeking, while complexity theory assumes that actors behave rationally bounded by their cognitive limitations (bounded rationality). Punctuated equilibrium theory argues that patterns of change and stability are caused, at least in part, by random variation, but does not rule out the effect of individual action.</p> <p>Overall, it is concluded that theories are not consistently explaining alignment. Further research is required to resolve competing explanatory approaches to provide and internally consistent explanation of how alignment occurs.</p>

Vessey and Ward (2013)

Theoretical basis	Complexity theory
Method	Conceptual paper
Research aim	Development of a co-evolutionary theory of IS alignment that explains how sustainable alignment occurs. The concepts of the co-evolutionary theory are illustrated by an analysis of the co-evolution of enterprise architectures and IS development projects (structural properties of IS, operational level).
Findings/contributions	<p>The paper offers a non-deterministic process theory that describes the dynamic process of sustaining alignment over time. In contrast to the principles of complex adaptive systems, particularly the self-organizing principle, an explicit role for management is acknowledged.</p> <p>The theory is based on the notion of co-evolution of business and IT in response to changes in the environment. The theory assumes that IS adaptivity is driven by bottom-up, emergent or adaptive processes (adaptive IS management) that take place in the context of top-down management directives (administrative IS management). Both processes need to be balanced to support effective adaptations (enabling IS management).</p>

Gerow et al. (2014a)

Theoretical basis	Not explicated
Method	Literature review and meta-analysis of alignment's nomological network
Research aim	Consolidation of prior research on business-IT alignment to understand whether alignment leads to firm performance.
Findings/contributions	<p>The findings provide evidence that alignment is an important determinant of various aspects of firm success. It is demonstrated that OBITA is more strongly linked to customer benefit than strategic alignment. In contrast, strategic alignment and cross-domain alignment was found to be more strongly related to financial performance as compared to OBITA.</p> <p>The authors further assume that governance structure and environmental turbulence act as antecedents of OBITA.</p>

Gerow et al. (2014b)

Theoretical basis	Strategic alignment model (SAM)
Method	Qualitative study (n=140)
Research aim	Refinement of the theoretical definitions of the business-IT alignment types (intellectual alignment, OBITA, business alignment, IT alignment, and two types of cross-domain alignment), development of consistent measures for each alignment type, and test of their relationship with financial performance.
Findings/contributions	The paper extends prior literature, which hardly conceptually distinguished between the types of business-IT alignment. The more precise definitions offered in this paper specify the level of analysis, highlight the focus of each business-IT alignment type and specify the components that were being aligned. Moreover, a measurement instruments for all types of alignment is developed.

Vermerris et al. (2014)

Theoretical basis	Not explicated
Method	Qualitative study (4 cases)
Research aim	Identification of the optimal timing of four actionable alignment practices (communication, shared understanding, management commitment, and IT investment evaluation) at the operational level (i.e., IT projects) by considering separate phases (planning phase, conversion phase, and use phase) in which the practices can be applied to increase/ensure IT-business value.
Findings/contributions	<p>The findings reveal that the IT-business value of IT project outcomes is contingent on business-IT alignment practices. These practices should be applied already in early phases of the project not only in the use phase. The results indicate that when alignment practices are complementary applied in the separate phases, higher levels of IT-business value could be realized.</p> <p>It is concluded that there is “indeed no time to waste in a project regarding the employment of all four alignment practices at the immediate start of the project” (Vermerris et al. 2014, p. 649).</p>

Wagner et al. (2014)

Theoretical basis	Social capital theory
Method	Quantitative study (n=132)
Research aim	Analysis of how social aspects of operational business-IT alignment conceptualized as social capital drive organizational performance.
Findings/contributions	<p>The findings indicate that the social aspects operational business-IT alignment have a significant impact on the value derived from IT in organizations as reflected by IT flexibility, IT utilization, and organizational performance.</p> <p>Moreover, the paper demonstrates that social capital theory is a useful theoretical foundation for research on operational business-IT alignment.</p> <p>Concerning the outcomes of operational business-IT alignment, this study shows that IT utilization and IT flexibility mediate the effect of strong social capital on organizational performance.</p>

Zolper et al. (2014)

Theoretical basis	Social network theory and boundary spanning theory
Method	Qualitative study (7 cases)
Research aim	Qualitative study (7 cases)
Findings/contributions	<p>The paper demonstrates that the characteristics of social structures that are relevant at the operational level are related to those at more strategic levels: frequent interaction, shared knowledge, and trust.</p> <p>It is also shown that there need to be individuals that act as dedicated boundary spanners between business and IT. The aspects of the social structure, namely the number of people they are connected to (in their own unit and in the other unit), the frequency of interaction, shared cross-domain knowledge, goals, and trust with these people as well as complementary knowledge impact the degree to which IT applications are effectively and efficiently maintained and enhanced.</p>

Schlosser et al. (2015)

Theoretical basis	Social capital theory
Method	Quantitative study (n=132)
Research aim	Analysis of the role of IT governance mechanisms in achieving social business-IT alignment at the operational level (conceptualized as social capital between business and IT and business knowledge of IT) and thus improving business performance (focus on the financial service industry).
Findings/contributions	<p>The paper demonstrates that formal and informal IT governance mechanisms improve social capital between business and IT. Concerning the second dimension of social alignment at the operational level, it is shown that only informal IT governance integration mechanisms significantly enhance business knowledge of IT. It is also indicated that informal integration mechanisms have a significantly larger effect on social alignment at the operational level. However, both dimensions of social alignment at the operational level were found to be positively related to business performance.</p> <p>Analyzing the governance mechanisms in detail, the paper shows that top management support for business-IT collaboration and IT representation on the executive board are important drivers of social alignment at the operational level. In contrast, regular meetings on specific topics, interaction incentives, and colocation unfold –if any– only small effects on social alignment.</p>

Gerow et al. (2016)

Theoretical basis	Resource-based view
Method	Literature review and meta-analysis
Research aim	Development of theoretical arguments that offer a deeper understanding of the relationship between business-IT alignment and firm performance.
Findings/contributions	<p>The paper demonstrates that strategic and OBITA are unique, but reciprocally dependent.</p> <p>Operational alignment was found to directly impact productivity and indirectly impact customer benefit and financial performance.</p> <p>Social alignment was found to be a determinant of both strategic alignment, but not of OBITA.</p> <p>Moreover, the authors conclude that “more researchers should specifically consider OBITA (either individually or with intellectual alignment) as this alignment type is neglected when compared with intellectual alignment” (Gerow et al. 2016, p. 447)</p>

Paper I

Acceptance and Use of Electronic Medical Records

An Exploratory Study of Hospital Physicians' Salient
Beliefs about HIT Systems

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Paper II

Exploring Determinants of Effective Use

The Role of Misfits between a Hospital and Its Information System

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Paper III

An Activity-Theoretical Extension of Technology Affordances in Healthcare

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An Activity-Theoretical Extension of Technology Affordances in Healthcare

ABSTRACT

Information technology (IT) is likely to improve healthcare delivery performance. However, the outcomes of implementing IT are mixed. Insufficient consideration of the implementation context was found to limit our understanding about why systems that work well in one setting may fail in another. We confronted these shortcomings by developing an activity-theoretical perspective on technology-affordance actualization in healthcare and analyzing the roles the electronic medical record (EMR) plays in two distinct, yet comparable use-contexts. Conducting a multiple case-study in six hospitals in Germany and the US, this paper provides theoretical and empirical evidence that affordances actualization relates to the characteristics of activity system components, their complementary nature, and dynamic interplay. Building on these findings, we provide a classification of EMR-related contradictions that influence EMR affordances actualization. Accounting for the materiality of the technology and the socio-organizational characteristics of healthcare, this classification offers guidance for developing accompanying measures for IT-related organizational change.

Keywords: Technology Affordances, Activity Theory, Healthcare Information System, System Usage, Case Study

1 INTRODUCTION

Research provides compelling evidence that emphasizes that information technology (IT) is likely to improve the performance of healthcare systems worldwide (Gauld et al. 2014). However, the outcomes of implementing such technologies, particularly electronic medical records (EMR), are mixed (Cresswell and Sheikh 2013; Jones et al. 2014; Kilsdonk et al. 2016). Hereof, research indicates *that* health information systems (HIS) are often hardly aligned with the needs and characteristics of prospective users and the socio-organizational elements of the healthcare sector (Tan and Or 2015) and *that* healthcare professionals' contextual realities are crucial to explaining HIS usage behavior (Mettler et al. 2017). Nonetheless, an insufficient consideration of the context was found to limit our understanding of *why* systems that work well in one setting may fail in another (Fichman et al. 2011; Jones et al. 2014). Thus, the literature emphasizes the need for theory-driven research that explores the distinct role HIS plays in healthcare considering its diverse organizational and social peculiarities (Fichman et al. 2011; Strong et al. 2014).

Recent research shows that, accounting for the characteristics of users, context, and technology, affordances are a powerful concept for understanding and explaining behavior and technology use (Grgecic et al. 2015; Piccoli 2016), as well as IT-related organizational change processes (Strong et al. 2014). Technology affordances are conceptualized as the emergent properties of the actor-environment system that determine what can be done with technology (Norman 1999). Though much research is concerned with the emergence of technology affordances (Pozzi et al. 2014), a profound theoretical understanding of the process of enacting affordances still needs to be developed (Strong et al. 2014). Aiming to extend the theory of technology-affordance actualization (Strong et al. 2014) and to contribute to our knowledge about the role HIS and contextual features play, we ask *under which conditions are affordances of HIS actualized?*

We approach this question by augmenting technology-affordance theory with cultural historical activity theory. Using affordances as an analytical lens allows one to explain situations where “seemingly different social behaviors” take place in “seemingly similar material conditions” (Gaver 1996, p. 112). Applying the activity-theoretical concept of activity systems enables us to account for and analyze the materiality of HIS and the socio-organizational characteristics of healthcare delivery in different contexts. The notion of contradictions within these systems further helps to identify how the interplay between the functional properties of HIS and the distinct contextual characteristics influence the enactment of technology affordances. Thus, the theoretical focus of this study shifts away from the actor or the technologies, the areas that most prior research on HIS usage considers (Abouzahra et al. 2015), toward an expanded view that accounts for how HIS usage unfolds in situated and emergent contexts and how it affects these contexts.

In this paper, we use the activity-theoretical focus to analyze two distinct EMR use-contexts within six hospitals in Germany and the United States. Among others, we show that the actualization of affordances relates to the characteristics of the activity systems. Analyzing these characteristics, we derive a classification for the EMR-related contradictions that influence the actualization of EMR affordances in organizational contexts. We start by developing our activity-theoretical extension of affordance theory, based on prior literature.

2 THEORY

2.1 Theory of Affordances

The general theory of affordances was introduced by the ecological psychologist Gibson (1986) to study the limits of and the possibilities offered to an actor by the environment. For Gibson, humans, along with animals, relate to material objects in their environment in terms of their affordances, which are the possibilities that they offer for action. Gibson (1986, p. 129) states that “*affordances* of the environment are what it *offers* the animal [actor], what it *provides* or *furnishes*, either for good or ill. [...] I mean by it something that refers to both the environment and the animal [actor] in a way that no existing term does [...]. An affordance points both ways, to the environment and to the observer.” So, affordances

emphasize a reciprocal and immediate relation between material objects in the environment and the actor(s).

Several studies in informational systems (IS) embrace the affordance concept in analyzing the interdependency of social action and the materiality of information technology (hereafter, just technology), as well as its effects (see, e.g., Gaskin et al. 2014; Goh et al. 2011; Leonardi 2011; Leonardi 2013b; Markus and Silver 2008; Mettler et al. 2017; Robey et al. 2013; Strong et al. 2014; Volkoff and Strong 2013). For instance, developing their affordance-actualization theory, Strong et al. (2014) show that affordances provide a theoretical perspective useful to study the intertwined relationship between “the material” and “the social” and how this relationship affects the outcomes of technology implementations through the actualization of affordances. We will come back to the actualization of affordances later. First, we will discuss the relationship between materially and socially bestowed affordances.

2.1.1 Dispositional and Relational Properties

The materiality of technology refers to “the arrangement of a technological artifact’s physical and/or digital materials into particular forms that endure across differences in place and time” (Leonardi 2013a, p. 69). These material properties may enable and constrain an actor’s attempt to engage in some activity. For example, a computer that is equipped with a touch screen and a stylus may have the affordance to directly add sketches to an electronic patient record, while a standard computer does not offer this possibility. However, the affordance to add sketches to an electronic patient record is not only dependent on the material properties of the technical objects as composed by their creators (e.g., the stylus can be held in the hand). Users also need to perceive, understand, and grasp material properties and their meanings (e.g., the stylus is designed for digital sketching) (Hutchby 2001). Consequently, affordance theory assumes that the possibilities for action that technologies offer are constituted in a type of relationship between a specified user, her capabilities and goals, and a technology’s materiality (Leonardi 2011; Markus and Silver 2008).

Following this line of thought and cutting across traditional subject-object dualities (Gibson 1986), recent literature on technology affordances admits that what bestows affordances upon technologies are a set of real, that is, objective, physical properties of the technology (dispositional properties) and properties emerging from the relationships between the user and the technology (relational properties) (Fayard and Weeks 2014; Hutchby 2001). Dispositional properties refer to a finite number of possibilities for action that are situated in and bounded by the materiality of the technology. These structural properties are external to the perceiver (Markus and Silver 2008), are independent of its use and the use-context (Faraj and Azad 2012; Fayard and Weeks 2014), and offer possibilities for action even when they are not perceived (Hutchby 2001). In contrast, relational properties only emerge when these real properties are related to an actor or a group of actors. Thus, the interplay between the objective and the subjective properties bestows technology affordances: the actor and her context identifies what she may be able to do with the technology (Fayard and Weeks 2014; Leonardi 2013a). That implies that actors can, but must not, perceive the properties that derive from a technology’s materiality (e.g., digital or physical modalities) and what they afford (e.g., the ability to capture sketches). Consequently, “an affordance is neither an objective property or a subjective property; or it is both if you like” (Gibson 1986, p. 129).

According to this reasoning, Stoffregen (2003, p. 124) defines affordances as emergent “properties of the actor–environment system that determine what can be done.”

Research in IS has uncovered that subjective properties relate to an actor’s orientation towards an immediate concrete outcome (Faraj and Azad 2012; Markus and Silver 2008; Volkoff and Strong 2013), her ability to interpret and perceive opportunities for action (Norman 1999), and sociocultural and/or organizational rules to which the technology is tied and that shape the perceptions and meanings over time (Hutchby 2001; Mettler et al. 2017; Strong et al. 2014). This implies that different people may perceive different affordances of a single technology and its objective properties. Moreover, the same person may perceive different affordances at different points of time or in different contexts (Piccoli 2016). Though affordances of an object may not per se be fully and immediately available to perception, they can be learned such that they are perceivable by the ones who are supposed to use the artefacts (Hutchby 2001). Likewise, designers and developers can draw on established sociocultural and organizational norms when creating technologies (Norman 1999) so as to impose particular meanings on the technology. For instance, by incorporating roles, hierarchies, organizational knowledge, and standard operating procedures, they may seek to limit the range of possible interpretations open to users (Hutchby 2001; Volkoff et al. 2007).

In summary, material and subjective properties are viewed as mutually dependent entities that are put into a relationship with one another through human action (Leonardi 2013a). Because people come to materiality with diverse goals, they perceive a technology as offering distinct possibilities of action. An actor’s perception of these affordances can change across different contexts, though the artifact’s physical properties do not change (Faraj and Azad 2012; Robey et al. 2013). So, affordances refer to the mutual interplay of materiality and goals, perceptions, conventions, and all other phenomena typically defined as social. This relationship identifies, but does not determine, the space for action. Affordances are thus seen as constraints in the sense that they delimit human agency by offering the possibility for certain actions and preventing others, which may, however, differ from user to user (Robey et al. 2013). Nonetheless, the properties of the material and the social are not fixed but can be altered through human agency (Leonardi 2011). This reciprocity between an actor and the environment evolves as a dynamic convergence bounded in the space spanned by the material and the social (Jung and Lyytinen 2014).

2.1.2 Effects of Technology Affordances

As indicated above, affordances require actualization to be effective, that is, the actions taken by individuals to realize affordances’ potential for action (Markus and Silver 2008; Strong et al. 2014). The literature shows that affordance actualization depends on contextual factors such as constraints in the physical and social environment (Jung and Lyytinen 2014; Strong et al. 2014). Thus, the context in which actors are embedded not only affects the emergence of affordances but also the actions that are taken (Strong et al. 2014).

At the group- and organizational levels, the potential for action technology offers is realized through patterns of feature use (Leonardi 2013b). Hereof, the likelihood of affordance actualization is found to be contingent on the meanings and values a technology communicates to a specific user group (Goh et al. 2011), which, again, may be shaped by its materiality and social conventions. Though technologies may have preferred interpretations,

meanings, and values built into them, these are always dependent on human agency to enact them. Thus, actualization of affordances may deviate from an intended ideal or schematic form as, for instance, codified in standard operating procedures (Robey et al. 2013). As Orlikowski (2000, p. 412) noted, people “have the option, at any moment and within existing conditions and materials, to ‘choose to do otherwise’ with the technology at hand.” Consequently, people can, instead of embedding technology in their activities, discard it, ignore it, or use it merely as an accessory (Robey et al. 2013).

Either way, how people deal with affordances influences their behavior (ways of using technology) and the ultimate effect technologies have (DeSanctis and Poole 1994; Markus and Silver 2008). At the organizational level, these effects may include the realization of overarching organizational goals such as higher quality or efficient use of resources. To realize these outcomes, affordances need to be collectively actualized (i.e., consistently across organizational actors and to the extent required), and combinations of affordances must be aligned with overarching goals (Strong et al. 2014). However, people may use technologies in a manner that is or is not consistent with the outcomes the organization intends. Thus, the affordances’ dispositional and relational properties do not, per se, contribute to achieving these goals.

2.1.3 Summary and Research Gap

Though the notion of affordances is seen as a powerful concept for understanding and explaining behavior and technology use (Grgecic et al. 2015; Piccoli 2016), Strong et al. (2014) note that literature has not yet developed a profound theoretical understanding of the process of enacting affordances, particularly within an organizational context. This study builds upon their deliberations on affordance actualization and responds to their call to further develop theory about why and when affordances are actualized within an organizational context. In line with most prior research, we expect that a theoretically grounded exploration of the interplay of material, social, and human agency will enable us to understand the conditions under which affordances of HIS arise and when they are enacted.

Building on the theoretical arguments outlined above, we view affordances as a multi-level concept referring to *the potential for actions associated with achieving an outcome that arises from the materiality of the technology and the relation between the technology and one or multiple goal-directed actors within an actor-environment system*. To improve our understanding of the mechanisms that lead to affordance actualization, we blend affordance theory with theoretical concepts from cultural historical activity theory: activity systems and contradictions. The activity system concept is expected to enhance our theoretical understanding of how material and social properties intertwine in ongoing activities that are bound to place and time and thus help us to improve our understanding of the actor-environment system at the level of the collective. Moreover, the notion of contradictions seems to be a valuable theoretical lens for analyzing why affordances may or may not be actualized.

2.2 Activity Theory

According to Leont'ev (1978), a pioneer of activity theory (AT), human activities consist of goal-directed actions by multiple actors that are realized through operations. Human activities are always directed to satisfy a need through a mutual object. The subject's reflections of and expectations for this object is the motive of the activity and provides answers to the question of *why* individuals engage in an activity. The activity is carried out through social actions that are performed in a socio-cultural actor-environment system, the activity system, that regulates *what* actions ought to be taken.

2.2.1 Conceptualizing the Actor-Environment System

By introducing activity systems as an analytical concept, AT offers a reasonable compromise between the opposite extremes of ignoring the context of social action (the actor-environment system) and extending the context to the point where it becomes overly complex and unmanageable (Kaptelinin et al. 1995; Kuutti 1991). Being the primary unit of analysis, the activity system covers *how* manmade artifacts and social conventions govern the collective work of diverse actors to achieve a desired outcome through a material or ideal *object* (Engeström 2001). In addition to the shared object, the activity system comprises the people who are working on the object (the *subjects*), the technology and other material or cognitive artefacts (the *instruments*) employed to achieve the desired outcome more efficiently; explicit regulations, policies, and conventions; and the implicit social norms, standards, and relationships that govern collective work (the *rules*); the horizontal division of tasks between actors and the vertical division of power and status (the *division of labor*); and the wider *community* of individuals and subgroups that focus at least some of their effort on the object (Engeström 1987; Engeström 1999; Kaptelinin 2005; Nicolini et al. 2012). Within these complexities, the object of an activity takes shape and acquires its value by being transformed through the actions of and interactions of the members of the activity system (Engeström 1999).

Within medical activities in hospitals, for instance, the mutual object is usually the treatment of patients. The actions and interactions of healthcare professionals are directed towards developing and implementing treatment plans aimed to restore good health or alleviate suffering. Besides the patients' wellbeing, the intended outcome of medical activities typically involves better-quality outcomes and sufficient revenue streams. Not only healthcare professionals are interested in these outcomes. There is also a community that involves the patient, other caregivers, researchers, and payers. The interrelations between healthcare workers, the community, and the patient are mediated by an array of instruments, including technologies, and governed by regulations and norms, as well as established roles and responsibilities.

Considering healthcare activities, the complex division of labor between professional groups (physicians, nurses, etc.), clinical areas (radiology, surgery, etc.), and healthcare organizations (primary care, hospitals, etc.) increasingly requires the documentation and communication of patient-related data (Ammenwerth and Spötl 2009). To deal with these necessities, healthcare professionals developed and enhanced several instruments that facilitate the quality and accessibility of medical documentation and improve the professionals' ability to achieve high-quality care and patient-safety outcomes, etc. (Hillestad

et al. 2005). With the implementation of HIS, the modalities of the instruments increasingly shift from the physical (paper files) to the digital (information systems). In a constant interplay with the healthcare workers' focus on outcomes (quality of care, patient safety, etc.) and the social aspects of the evolving activity system, affordances emerge that allow the workers to comply with these necessities. For instance, HIS increasingly affords the ability to access and use patient information anytime from anywhere, to more efficiently coordinate patients across sites and providers, and to monitor their operations, etc. (Strong et al. 2014).

This indicates that, like the object, the instruments, rules, and the division of labor also evolve continually. According to AT, these socio-material elements connect members of an activity system, empower them with experience and skills collected in the past, and determine the possibilities of their actions and interactions. These, in turn, constitute and transform the activity (Kaptelinin 2005; Kuutti 1995; Nicolini et al. 2012; Vygotsky 1978). Consequently, AT acknowledges that instruments—in a constant interplay with the actors' abilities and social norms—offer and sometimes delimit possibilities for action. The evolving nature of the material and social elements of the actor-environment systems assumed by AT is closely related to the discussion of how affordances evolve through human agency. Hereof, Gibson (1986, p. 122) noted the following: “Why has man changed the shapes and substances of his environment? To change what it affords him. He has made more available what benefits him and less pressing what injures him.” Likewise, AT posits that instruments and their affordances are shaped by and shape human activity.

2.2.2 Contradictions within Activity Systems

In their interplay with individual and organizational goals, the material properties of an instrument may yield different affordances. For instance, instruments employed in medical activities may not only create possibilities for improving quality of care and patient safety but also for increasing revenue. Hereof, the material properties of HIS (standardized and centralized data) may offer the possibility of standardizing healthcare processes that support the goal of improving revenue. However, such actions may conflict with the goals of other actors who perceive HIS to offer them possibilities to incorporate rich information into clinical decision-making, to enhance personalized medicine, and, ultimately, to improve treatment, regardless of the cost. This indicates that affordances arising in collective activities must not be consistent or complimentary, but that technologies may emphasize contradictions within healthcare activities. Going back to the example of HIS, depending on the outcome one has in mind, the instrument can be viewed as a resource to treat patients better (an altruistic motive) or to improve revenue (an economic motive). Both motives may be present in medical activities at the same time.

When it comes to understanding the interplay between the social and the material in actor-environment systems, AT's notion of contradictions is valuable. The concept of contradictions describes problematic relationships between components of activity systems stemming from their complementary nature (mutuality, interdependence, diversity) and the dynamics that characterize changes in collective activities. AT assumes that, over time, activity systems and their constituents accumulate multiple perspectives carrying multiple layers and strands of history. “[P]arts of older phases of activities stay often embedded in them as they develop” and may contradict new developments such as emerging technologies and their affordances (Kuutti 1995, p. 26).

Contradictions within activity systems often manifest as tensions, disturbances, and breakdowns that destabilize the interaction of members of the activity system and produce inefficiencies that limit the ability of the collective to realize intended outcomes (Allen et al. 2013; Engeström 1999). Moreover, contradictions often lead to various issues in groups or entire organizations—such as a resistance to using instruments as intended (Engeström and Punamäki 1999). As human activities are virtually always in the process of working through contradictions, AT views them as primary driver of the advancement of human activities (Engeström 2001). Contradictions lead individuals or groups to reflect and adapt the social and material constituents of their activity—for example, the social conventions or functional properties of the instruments employed (Cole and Engeström 1993).

2.2.3 Summary and Initial Propositions

AT emphasizes the instrument-mediated nature of healthcare work and offers a coherent framework for analyzing actor-environment systems and the role of technologies within them. Conceptualized as an “affordance generation system,” the activity system frames the interplay of the material properties of technology (instrument), the actors’ capabilities and goals (subject, community, and object), and the social aspects of human activity (rules and the division of labor). By interrelating “the material” and “the social” within an activity system, AT offers a theoretical account for the analysis of why affordances of HIS arise and when they are enacted in a collective actor-environment system. Figure 1 offers a simplified example of a general activity system for medical activities concerned with documentation.

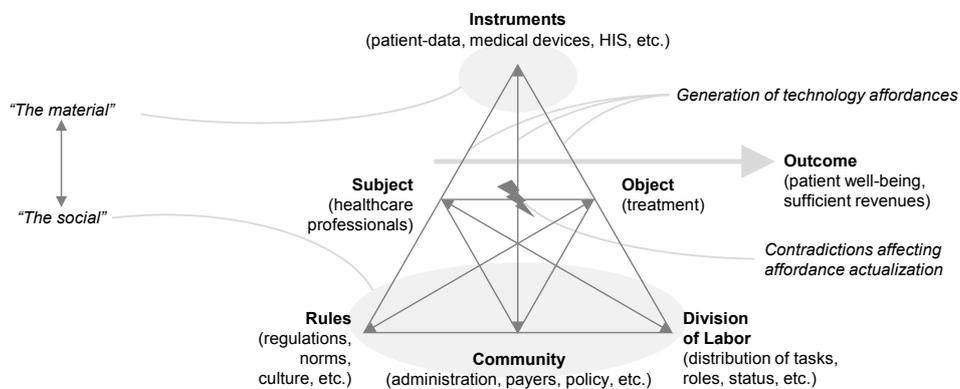


Figure 1: Generic medical activity system as “affordance generation system”

From an ontological stance, we adopt a critical realistic view of affordances (Volkoff and Strong 2013) that emphasizes the distinction between agency and structure. In critical realism, structures, defined as “sets of internally related objects or practices” (Sayer 2010, p. 92), are assumed to create the conditions for action (Volkoff and Strong 2013). Structures may have causal powers or tendencies to do certain things, “which may or may not be enacted in a given context to generate the events manifest as empirical evidence” (Wynn and Williams 2012, p. 791). Based on our theoretical deliberations, we assume that analyzing the activity systems enables us to identify the sets of internally related entities that may have affordance-related power. We further assume that actualization of affordances is influenced by the multiple relationships between the components of an activity system. These structures are

expected to provide an explanation for how and why technologies are employed in practice (Volkoff and Strong 2013). More particularly, the contradictions that emerge from multiple points of view, traditions, and interests accumulated in collective activities are assumed to limit affordance actualization and jeopardize the expected outcomes of HIS implementation.

3 METHODS

Conducting a multiple exploratory case-study in distinct yet comparable settings, we identify the features of activity systems that lead or do not lead to HIS affordance actualization. While we acknowledge that each instance of an affordance is specific to a distinct actor-environment system, we follow Volkoff and Strong (2013) and assume that the structural features that apply to a variety of settings may generate generic HIS affordances. We seek to identify those features of activity systems that most likely relate to the emergence and actualization of these generic organizational-level HIS affordances by comparing the actions observed and the activity systems (particularly contradictions). Hereby, we search for explanations for why some generic HIS affordances are or are not enacted in all sites. For the identification of the organizational-level HIS affordances, we draw on the generic HIS-related affordances as identified by Strong et al. (2014).

3.1 The Cases

To identify activity system features that influence HIS usage behavior, this study focuses on how physicians deal with electronic medical records (EMR). EMR is an umbrella term for many automated clinical systems (Goo et al. 2015) and is commonly defined as a technology that is capable of handling health information and data, results management, order entry, decision support, electronic communication and connectivity, patient support, administrative support, reporting, and population health management (Blumenthal and Glaser 2007). The EMR is assumed to replace paper-based documentation in hospitals and typically offers basic affordances like capturing and archiving digital data about patients and accessing and using patient information anytime from anywhere. It also is assumed to provide follow-on affordances like coordinating patient care across sites, facilities, and providers; standardizing data, processes, and roles; monitoring organizational operations; substituting healthcare professionals for each other; incorporating rich information into clinical decision-making; and shifting work across roles (Strong et al. 2014).

Empirical data was collected in two hospitals in Germany and four hospitals in the United States (California). Although both healthcare systems are highly developed (see e.g., the Commonwealth Fund “Quality Care” ranking), there are structural differences that shape the activity systems of inpatient treatment (Gauld et al. 2014). While there is no national strategy for HIS in Germany, EMR adoption is a priority for the US government. The Health Information Technology for Economic and Clinical Health (HITECH) Act provided between \$25 and \$36 billion in incentive payments to promote the utilization of EMR systems to improve the efficiency and quality of healthcare in the US (Blumenthal and Tavenner 2010; Edmunds et al. 2016). The financial incentives are complemented by certification requirements and regulations that encourage providers to use certified technologies and to

show that they are using EMR in a “meaningful way” (Blumenthal and Tavenner 2010; Jones et al. 2014). There is evidence that the HITECH Act increased competitiveness and innovation in the HIS industry (Joseph et al. 2014) and that it facilitated the diffusion of systems that enable more efficient provision of healthcare service through accounting for usability, data flow, and flexibility requirements (Edmunds et al. 2016). Following a theoretical replication strategy, we expected that these differences would yield contrasting EMR affordance-actualization patterns in hospitals in the US and Germany (Eisenhardt 1989; Yin 2009). An analysis of the activity systems that may produce them is expected to enhance our understanding about characteristics of the actor-environment system that cause affordances to be actualized or not be actualized. Table 1 provides characterizing information on the hospitals.

Table 1: *Characteristics of the case sites*

Hospital	Brief Description
Hospital G1 (Germany)	University medical center; 1,500 beds; ranks among the 10 largest hospitals in Germany; comprises several different clinics; unified administrative back-office system complemented by several EMR systems; many clinics still use paper-based medical records in parallel.
Hospital G2 (Germany)	Specialized clinic; part of a larger hospital group; approx. 250 beds; two departments are run by a university medical center; unified EMR system; challenges regarding the handover of data between organizations (hospital group and university medical center); relies to a large extent on paper-based medical records in addition to the electronic systems.
Hospital U1 (USA)	University medical center; approx. 500 beds; ranks among the 10 largest hospitals in the United States; comprises several different specialized clinics; unified EMR (off-the-shelf system; mandatory usage for all clinics); no paper-based records of any form.
Hospital U2 (USA)	Maximum-care clinic; part of a nationwide organization; approx. 1,000 beds; unified HIS across all locations (proprietary system, mandatory usage); no paper-based records.
Hospital U3 (USA)	Maximum-care clinic; part of a state-wide medical group; approx. 250 beds; unified EMR (mandatory usage; off-the-shelf system; customized to the group); no paper-based records
Hospital U4 (USA)	Maximum-care clinic; part of a nationwide nonprofit group; approx. 800 beds; unified EMR (off-the-shelf system; mandatory usage); no paper-based records.

3.2 Data Collection and Analysis

Following the advice of Markus and Silver (2008), the relevant user groups were carefully specified. In this study, we primarily focus on physicians. We gather data on their EMR usage behavior and their perception of the components of the activity system. Forty-three (43) interviews with physicians were conducted, transcribed, and analyzed. To broaden our

knowledge of the activity system and to reconsider the physicians' assertions, we conducted 22 interviews with administrative staff and nurses.

The interviews were performed by two researchers and supported by a predesigned guideline (Miles and Huberman 1994) that contained a list of questions concerning the characteristics of medical documentation activities (importance, constraints, etc.), the nature and role of the HIS employed (functional properties, relations to the actor-environment system), and their HIS usage. Unfortunately, most interviewees did not agree to having the interviews recorded. However, during and after each interview an extensive number of notes were taken. The notes were then digitized in a research diary. To triangulate empirical evidence, one researcher spent more than forty (40) hours observing HIS usage at four hospital wards in Germany (G1 and G2) and the USA (U2 and U3). By accompanying physicians on their ward rounds, during team meetings, in patient interactions, and while finishing documentation, the researchers collected additional data on EMR affordance actualization. These observations were also captured in notes, digitized, and added to the research diary. Overall, data collection took place from June 2015 to February 2016. Table 2 provides an overview of the interviewees and their respective disciplines.

Table 2: Overview of interviewees

		Surgery	Intensive care	Internal medicine	Ortho- pedics	Others	Total
Germany	Physicians	4	7	3	-	9	23
	Others	1	4	5	6	-	16
USA	Physicians	6	2	4	7	1	20
	Others	1	-	1	1	3	6

Once data collection was completed, we analyzed the data using the software NVivo. In a first cycle, we applied open coding to condense and categorize the data and to identify broad themes (e.g., conventions that govern medical documentation; enablers, opportunities, and constraints related to EMR) (Miles and Huberman 1994). When a few new open codes emerged, pattern coding was applied to reveal relationships among the characteristics of the activity systems (activity system components and their relations; observable structures) and the observed EMR affordance-actualization themes (the generic HIS affordances that were enacted in the hospitals; observable actions). When the data revealed interesting patterns, memos were written and the patterns discussed within the research team. During pattern coding, we found that the features of the activity systems and the related EMR affordance-actualization patterns did not significantly vary between the hospitals of a country. However, we noticed that healthcare workers in the US and Germany used the EMR in diverse ways (see Table 3). Thus, we decided to create a conceptual matrix that summarizes the findings across the countries and enables us to identify relations between affordance actualization in hospitals in the US and Germany and the characteristics of the underlying activity systems. Table 4 represents a condensed summary of this matrix.

4 FINDINGS

Data analysis revealed that healthcare professionals in US hospitals more consistently actualized the generic affordances the EMR was found to offer. Below, we present *which* organizational-level affordances were enacted in the US compared to German hospitals (affordance-actualization patterns; actions). Next, we analyze relationships between the affordances, the characteristics of the activity systems, and, particularly, the contradictions within these systems (structures with causal powers). In doing so, we outline our critical realistic interpretation of *why* some affordances were enacted and others not.

4.1 Emergence and Actualization of EMR Affordances

The prerequisites that are expected to give rise to the generic EMR affordances as proposed by Strong et al. (2014) were given. The EMR offered features like structured data-entry forms, messaging features, role management, audit trails, task lists, reminders, and decision-support features. The healthcare professionals possessed at least the basic skills needed to perform actions like updating and accessing patient data and utilizing coordination features. Nonetheless, the affordance-actualization patterns in US and German hospitals differed significantly. Table 3 provides an overview of the patterns that emerged from our data.

As Strong et al. (2014) note and as is evident in our data, healthcare professionals proceeded with the actualization process at different rates and in different ways. However, we found the individual affordance actualization of healthcare professionals in US hospitals to be more aligned, particularly concerning the two basic affordances of capturing and archiving digital data and accessing and using these data. Among others, actualizing these affordances enable healthcare workers to more efficiently use their resources and the organization to reduce costs. In contrast, we found many of the German healthcare professionals to be heavily dependent on involuntary paperwork. As a senior physician in G1 stated, “*It is amazing how many people run around and carry paper files from one place to another.*” Consequently, when seeing patients, physicians often have difficulties considering recent patient and treatment data as they do not have it at their fingertips (assistant physician, G2). To remedy these inefficiencies, German physicians increasingly actualize these affordances. For instance, a senior physician in G2 stated she and her colleagues began to “*continuously update the discharge letters*” in the EMR system to speed up processes.

Table 3: *Affordance-actualization patterns*

EMR Affordances	US Hospitals (U1, U2, U3, U4)	German Hospitals (G1, G2)
Capturing digital data about patients	<i>Actualized:</i> Healthcare professionals manage virtually all patient-related data directly within the EMR and maintain complete patient history (per provider); data is keyed in during or immediately after patient interactions.	<i>Only partly actualized:</i> The EMR is used to capture patient-related data, however, data is still documented on paper; in many wards, paper files are omnipresent; physicians largely see the benefits of capturing digital data.

EMR Affordances	US Hospitals (U1, U2, U3, U4)	German Hospitals (G1, G2)
Accessing and using patient information anytime from anywhere	<i>Actualized:</i> Physicians retrieve all relevant and available data pertaining to each patient encounter before or after seeing patients; remote access is used to prepare for work and finish documentation.	<i>Only partly actualized:</i> Sometimes relevant data is missing as it is on paper and not yet filed or scanned; physicians' possibilities for preparing work and finishing documentation outside the ward are limited.
Coordinating patient care across sites, facilities, and providers	<i>Largely actualized:</i> The EMR is used to communicate patient-related issues to other departments and to coordinate tasks (e.g., medication, discharge decisions); limited integration of systems inhibits efficient coordination of patient care across providers.	<i>Partly actualized:</i> Though physicians use the EMR for order entry and requests, cross-departmental coordination requires a great deal of effort; coordination between providers is mostly done by telephone and discharge letters.
Standardizing data, processes, and roles	<i>Largely actualized:</i> The EMR supports healthcare workers by standardizing content and structure documentation and processes like order entry, medication, and consultation; in cases of emergency, phone and paper notes are still preferred.	<i>Hardly actualized:</i> Physicians and nurses often use different documentation modalities (EMR, paper); the content and structure of documentation and processes are hardly standardized across organizational units; nearly every ward uses individualized paper forms besides the EMR.
Monitoring organizational operations	<i>Increasingly actualized:</i> Physicians monitor and improve processes during data-quality reviews, performance reviews, and treatment reviews through analyzing data provided by the EMR.	<i>Not actualized:</i> Some physicians perceive the EMR to afford monitoring capabilities and improve operations such as capturing and improving wait times; healthcare workers were not found to use the EMR to monitor organizational operations.
Substituting healthcare professionals for each other	<i>Increasingly actualized:</i> Physicians use the EMR to reduce dependency on others (e.g., preparing for shift changeover); reminders offered by the EMR enable detachment of patient and task management from single persons.	<i>Hardly actualized:</i> The EMR is used to shift documentation tasks to physicians on nightshifts (e.g., writing up treatment and medication plans); documentation for shift changes is often created manually.
Incorporating rich information into clinical decision-making	<i>Increasingly actualized:</i> Physicians use the EMR's alert functions and its recommendations as part of their decision-making process.	<i>Increasingly actualized:</i> Physician use the suggestions offered by the EMR when prescribing medication; internet resources are used to obtain information on medication and treatment.

EMR Affordances	US Hospitals (U1, U2, U3, U4)	German Hospitals (G1, G2)
Shifting work across roles	<i>Increasingly actualized:</i> The personal action plans and routine checks offered by the EMR enable nurses to take over specified medical tasks like anamnesis and vaccination.	<i>Not actualized:</i> The EMR is hardly used to shift work across roles; physicians only perform administrative tasks if they absolutely must (coding, billing, etc.).

Capturing timely, consistent, and accurate data in the EMR is found to be a prerequisite for accessing these data anytime and from anywhere. They also determine the emergence of other EMR affordances like coordinating patient care, monitoring operations, enhancing decision-making, substituting healthcare professionals, and shifting work across roles. Consequently, even if healthcare professionals perceived these other affordances, our informants in Germany were found to have greater difficulty in actualizing them. For instance, to use the EMR for coordinating patient care across different departments, relevant information must not be kept outside the EMR. In Germany, we found that, although physicians and nurses at the wards increasingly utilize the EMR to capture and access relevant patient data, the functional departments lag in this respect. Often additional inquiries concerning the requests and/or the findings are required. This complicates coordination between the wards and the departments significantly. To give just one example, an assistant physician in G2 noted that “*When requesting an x-ray, the request is put into the system and then a phone call is made to inform the x-ray department.*” In contrast, coordination between departments and facilities via the EMR was found to be more seamless in US hospitals. Consequently, D01 concluded that “*It makes no sense if only physicians or only a few departments use the system.*”

In addition, data shows that an EMR affords different healthcare professionals complementary possibilities for action that, once actualized, facilitate the actualization of related affordances by other healthcare professionals. For instance, the possibilities for standardizing workflows the EMR offers may only be important for higher-ranked physicians who are responsible for managing a ward, a department, or a hospital. Though standardization is not contingent on an EMR, this instrument offers healthcare managers the opportunity to standardize data, processes, and roles (Strong et al. 2014). Data indicates that US hospitals largely actualized this affordance (“*Why should it be done differently? This is the standard in medicine these days,*” resident physician, U4). Hereby, EMR-enabled standardization was found to relate to the actualization of other affordances by lower-ranked healthcare worker (e.g., substituting healthcare professionals: “*With the system I can see what happened, i.e., during night shift, without having to ask about all the details,*” resident physician, U4) and department managers (e.g., monitoring operations: “*I can report on anything which helps me to manage my department better,*” senior physician, U3). Moreover, standardization of data, processes, and roles, as well as monitoring operations (e.g., by reviewing physicians’ coding), positively relates to the more basic affordances of capturing and using data. Consistent actualization of these basic EMR affordances is fostered by the existence of standards for documenting data and frequent reviews of compliance with these standards, as is found in the US hospitals.

Overall, data provides strong support for the findings of Strong et al. (2014). First, data analysis did not reveal affordances that could not have been assigned to one of the

affordance-related categories as identified by Strong et al. Second, the affordance-actualization patterns observed in the hospitals provide evidence that the bundles of EMR affordances are interrelated and interact in several ways. However, while capturing and using patient information was found to be critical for the emergence and actualization of follow-on affordances such as monitoring operations, dependencies among other affordances seem to be weaker. For instance, standardizing data, processes, and roles is enabling, but its absence does not completely prevent actualizing follow-on affordances such as coordinating patient care.

4.2 Analysis of the Activity Systems

As summarized in Table 4, our activity-theoretical analysis revealed that some characteristics of the activity system (AS) components differ significantly between the US and Germany. The divergent characteristics of the simplified activity systems point up EMR-related contradictions or tensions within the healthcare activity systems in German hospitals, which could not be observed in the American hospitals. Though the generic EMR affordances emerged and were partly actualized, the contradictions outlined below explain the actualization patterns in German hospitals. The first contradiction is caused by the dispositional properties of the instrument; the others are the result of the dynamic interplay between complementary elements of the activity systems.

First, the material properties of the EMR as mediating instrument were found to differ slightly. Principally, the range of functions offers possibilities for action as reflected by the general HIS affordances. However, differences concerning the material properties of the interfaces were observed. While the EMR employed in the US resemble interfaces of familiar software applications, the user-interfaces of the German EMR were found to confuse healthcare professional, resulting in a greater effort to access data (*"I need to perform three clicks to open this attachment,"* nurse, G2). These dispositional properties of the EMR contradict the healthcare professionals' goal of keeping the effort involved in menial tasks like documentation as low as possible, and they do not facilitate actualization of basic and follow-on affordances.

Table 4: Condensed summary of activity system characteristics related to EMR use

AS Component	Findings in the US Hospitals	Findings in the German Hospitals
Instrument (EMR, paper)	Functionalities of the EMR are mostly aligned with the general HIS affordances.	
	A small number of highly integrated HIS; sufficient hardware; clear interfaces close to popular systems in the consumer sector.	Many, rather loosely integrated systems; often insufficient hardware and confusing interfaces (“small fonts in big windows”).
	Paper-based instruments largely replaced.	Still many paper-based instruments in use.
Subject (physicians)	Sufficient computer skills (e.g., touch typing); dealing with IT is part of physicians’ professional training.	Basic computer skills are widely present but efficacy varies; dealing with IT does not is not part of professional training.
	Documentation is viewed as a core task.	Documentation is seen as a menial task.
	Capturing and maintaining patient- and treatment-related data is seen as being valuable for medical and management purposes (e.g., optimization of processes and outcomes like returns, quality of care) and in case of lawsuits.	Capturing and maintaining patient- and treatment-related data is primarily seen as being valuable for medical responsibilities; the provision of data for management is seen as a threat to the status quo (increased supervision and cost pressures).
Object (patients, medical record)	Treating patients as effectively as possible drives healthcare activities; the economic aspects become increasingly important (e.g., costs, efficiency, and service quality).	
	The patient is viewed as a customer and active partner.	The patient is viewed as a person to be helped rather than as an active partner.
Community	For management, the EMR constitutes the primary input for reimbursement and reports.	
	Policy, payers, and management expect healthcare professionals to improve cost structures (better coordination of workflows, avoiding unnecessary examinations, etc.).	
Division of Labor	Employees must be able to perform all tasks associated with clearly defined roles and related responsibilities.	Roles and responsibilities that developed over time are hardly questioned or adjusted.
	Modes of task distribution and the definition of roles and responsibilities are adapted if necessary (e.g., data entry during or immediately after the ward round); less pronounced boundaries exist between occupational groups.	Tasks are distributed per status (e.g., menial tasks are delegated whenever possible) and abilities (e.g., IT-savvy users perform documentation in the EMR); strictly defined interfaces between departments (“medical kingdoms”) and occupational groups.

AS Component	Findings in the US Hospitals	Findings in the German Hospitals
Rules	Compliance to standards that govern medical treatment and documentation is regularly reviewed.	Established practices and professional standards govern the actions and interactions; medical directors “reign.”
	Rules in place to measure and manage the quality of individual and organizational HIS usage (e.g., coding quality).	Hardly any explicit rules governing HIS usage (e.g., it is common for the nightshift to finish documentation for others).
	Rules in place to govern meaningful use of data (medically and economically); quality and treatment reviews are common.	Lack of conventions about how data should be used; documentation quality is not regularly reviewed.

Second, we found contradictions concerning the subject-object relationships in German hospitals that could not be identified in the US. Specifically, there are differences concerning the goals of healthcare professionals, their abilities, and how these account for the changing nature of the object of their collective activities. In both countries, the economic aspects of patient treatment become more and more important. Additionally, patients are increasingly seen as customers who need to be served and who actively shape their own treatment process due to the increased health literacy of the average patient. Healthcare professionals in the US were found to agree on these evolving aspects. These informants attribute the value offered by structured patient and treatment data from a medical and a business perspective. Therefore, they were found to gradually enact EMR affordances to improve processes and routines to account for the changing role of the patient. Also, physicians were found to view documentation as a core task of their activities as it requires them to continuously improve their skills. In contrast, physicians in Germany seem to view capturing data as a task to be delegated whenever possible. The value of structured data in the EMR and follow-on affordances such as improving coordination of patient care and improving medical decision-making is slowly getting noticed. Consequently, healthcare professionals put little importance on improving their IT-related capabilities. Rather, they perceive the EMR as a tool for management to increase supervision on healthcare delivery. Unfortunately, this threatens the physicians’ historically strong position in the execution of medical activities. This, in turn, influences their affordance-actualization behavior.

Third, we found significant differences regarding the historically evolved distribution of tasks, responsibilities, and status. The historically rooted importance of medical directorates in German hospitals produced many silos, that is, the so-called “medical kingdoms” that ensure the influence and status of medical directors. We also observed structural peculiarities such as rigid hierarchies and a strict functional division of labor between physicians and nurses that contributes to the need for manual coordination and inhibits shifting work across roles. The modes of task distribution contrast with the economic aspects of patient care. Although the EMR offers functionality for bridging hierarchies and enabling coordination within and between departments, the rigid organizational structures were found to hinder realization of these benefits. Contrasting these observations, we found roles and responsibilities in US hospitals to be less dependent on established power structures and historically evolved modes of task distribution. Supported by outcomes of prior affordance

actualization, these hospitals can draw on standardized data, processes, and roles. These, in turn, were found to foster actualization of follow-on affordances like shifting work between healthcare professionals. The interplay of technology and the division of labor allow physicians to schedule surgery together with the patients without being dependent on the responsible physicians in the central surgery department. Overall, we found considerable fewer contradictions between affordances of the EMR and the division of labor in the US hospitals compared to the German hospitals.

Fourth, the data revealed that affordance actualization in the US hospitals is promoted by clearly defined rules that govern EMR usage. These rules can be traced back to be a result of the HITECH Act, which financially incentivizes the meaningful use of data. Compliance with the set standards is reviewed regularly. German hospitals are also increasingly required to capture patient and treatment data electronically to comply with performance, compensation, and reporting demands. However, physicians have a high degree of autonomy regarding the organization of medical activities and possess privileges like control over critical resources and healthcare-related tasks (Walter and Lopez 2008). Hereof, in particular their sole decision-making authority was found to contradict affordances like monitoring of operations by nonprofessionals. Moreover, the lack of explicit rules to govern EMR usage was found to lead to uncertainty about the use of electronic data. We found that, while this contradiction between EMR affordances and the rules that govern medical activity does not prevent EMR affordance actualization, it also does not foster it.

5 DISCUSSION

This study provides theoretical and empirical evidence that AT enhances our understanding about the actor-environment system and the role of technology and its materiality within. Hereby, we are extending the theory of affordance actualization as proposed by Strong et al. (2014) and enhance the understanding of why systems, which work well in one setting, may fail in another.

5.1 Contributions to Theory

By analyzing comparable, yet distinct EMR use contexts within six hospitals, this study extends the evidence for the applicability of the classification of generic EMR affordances as provided by Strong et al. (2014). More importantly, we contribute to the affordance literature by showing that the actualization of affordances relates to the characteristics of activity system components, their complementary nature, and their dynamic interplay. Hereof, the findings revealed that the activity systems shaping patient treatment in the US hospitals are characterized by fewer EMR-related contradictions compared to the German hospitals. The contradictions identified in the actor-environment system provide an explanation of *why* affordance-actualization patterns differ significantly. In the following, we discuss the contradictions found to influence the emergence and actualization of affordances per three relationships within the activity systems that are mediated by the EMR and the functional properties that deviate from the paper-based legacy systems. Furthermore, we discuss how our activity-theoretical extensions of affordance-actualization theory improve the

understanding of the mutual and reciprocal interplay of interrelated and interacting EMR affordances and the characteristics of the activity systems.

The first category is concerned with the *subject-community-object relationship* and involves contradictions that emerge from different, evolving perspectives on the object of medical activities, related capabilities, and the functional properties of the EMR (hereafter type 1 contradictions). AT views the treatment of patients as the object of medical activities as an abstract entity that, over time, moves from a “problem space” to a meaningful shape (Engeström 1999; Engeström 2001). How patients are treated is not just up to healthcare professionals; it is also constantly shaped by numerous stakeholders such as management, policymakers, and payers. The latter increasingly contribute to the steady expansion of the problem space on economic aspects. AT assumes that if an expanded object is introduced into activity systems that are not designed to address it, contradictions arise (Engeström 1987). EMR are usually designed and implemented to improve quality and efficiency and reduce the cost of medical care (Chaudhry et al. 2006) and thus to create possibilities for action that the paper-based legacy-systems do not afford. However, simply replacing the instruments seems to be insufficient to resolve object-related contradictions such as contradictory economic and altruistic perspectives. Rather, implementing new instruments that have augmented affordances may amplify these type 1 contradictions. For instance, actors may perceive that EMR affordances emphasize management control over costs, which could result in restrictions regarding treatment options. Our findings revealed that type 1 contradictions and the resulting tensions should be addressed by sensitizing physicians to managerial aspects. Otherwise, these contradictions will impede the actualization of EMR affordances, even those that predate managerial affordances like standardizing and monitoring operations. Type 1 contradictions are also found to manifest as tensions between the design of the interfaces, which often resemble enterprise systems, and physicians’ skills. These contradictions may increase the efforts required for “menial” tasks and obstruct patient treatment (their motive), thus inhibiting affordance actualization.

Type 2 contradictions focus on the *subject-division-of-labor* relationship. They are concerned with the potential for EMR affordances to counter the distribution of tasks, roles, and responsibilities. From a historical viewpoint, the organizational culture in German hospitals does not facilitate full-scale cross-functional cooperation. Rather, these hospitals are seen as “decoupled organizations” (Doege and Martini 2008) characterized by strong hierarchies and occupational silos. These silos isolate medical disciplines, physicians, and nurses, as well as healthcare and administrative staff. The inherent inflexibility of the paper-based systems has enabled them to maintain these silos and related power structures. In contrast, offering possibilities to bridge organizational boundaries, to shift work across roles, and to substitute healthcare professionals, the EMR contradicts the evolved modes of task, responsibility, and status distribution. Actualization of these affordances seems to be related to attendant measures that mitigate type 2 contradictions such as organizational restructuring (American hospitals have a department structure), job rotations (American physicians often work in multiple hospitals), and the decomposition of boundaries between occupational groups (nurses can take over certain tasks of physicians) (Bardhan and Thouin 2013).

The third category refers to *rule-related contradictions* within activity systems and is concerned with rules that contradict EMR affordances (type 3 contradictions). As seen in the American hospitals, rules that govern the interactions of healthcare professionals with the

technology facilitate EMR affordance actualization. Tying technology to such rules should not only be seen as a means to influence behavior but also to shape the perceptions of physicians and the meanings assigned to technology (Hutchby 2001). Rules that govern the meaningful use of data and regular reviews of EMR outcomes are found to sensitize healthcare professionals to the economic aspects of patient treatment and thus also to mitigate type 1 contradictions. In contrast, a lack of such rules reinforces established practices and implicit rules that are aimed at preserving organizational silos and limits the possibilities for efficient exchange of data, etc. Comparing German and US hospitals provides evidence that, in the absence of such rules, the perceptions of the EMR and its affordances are primarily shaped by established practices and professional autonomy. These, in turn, were found to conflict with many follow-on affordances related to the exchange of patient and treatment data (e.g., standardizing data, processes, and roles, as well as coordinating patient care across units). Acknowledging the complementary nature of activity system components (Engeström 1987), the emergence and actualization of EMR affordances that follow on capturing and utilizing electronic data seem to be to some degree contingent on regulatory measures aimed at redefining the meaning and values physicians associate with actions the EMR and the data collected offer.

The theoretical and empirical evidence reveals that the interrelated and interacting EMR affordances arise from the relation between the dispositional properties of the EMR and the relational characteristics of the activity systems to which it is introduced. Analysis showed that affordance actualization is dependent on the interplay of activity system components, while the outcomes of affordance actualization affect these characteristics. Actualizing and discarding EMR affordances were found to resolve or reinforce contradictions within activity systems and thus influence the emergence of follow-on affordances. In line with similar findings (Goh et al. 2011; Leonardi 2011), realizing the possibilities of capturing and utilizing patient and treatment data anytime from anywhere, for instance, was found to be related to adaptations to the modes of task distribution and the definition of roles in US hospitals. These changes to activity-system elements, in turn, mitigated other tensions in the activity system and thus facilitated the actualization of follow-on affordances like incorporating rich information into clinical decision-making.

Overall, AT's notion of activity systems and contradictions improves our understanding of the iterative and reciprocal processes of IT-related change. Activity systems as theoretical means offer an approach to analyze the structure and mechanisms of actor-environment systems that frame social actions and are likewise reproduced and altered by these actions (Engeström 1987; Orlikowski 1992). The concept of contradictions within activity systems explains why affordances of EMR are not shared by all members of a group or the entire organization (i.e., type 1 contradictions) and why affordances that emerge as a combination of distinct but aligned affordances are not actualized (i.e., type 2 and type 3 contradictions). Consequently, AT enhances our capability to describe and analyze the actor-environment system, to predict implementation outcomes, and to develop measures that facilitate working through contradictions and thus advancing healthcare activities. Further research could draw on our theoretical deliberations, refine our classification of IT-related contradictions, and analyze how distinct types account for the actualization of shared and collective technology affordances in healthcare and other domains.

5.2 Limitations

The empirical data analyzed stem from a multi-case study limited to two countries. Moreover, the sample is restricted to six hospitals and to single departments and clinics within these hospitals. Further research should see whether analyzing activity systems and contradictions also explains the actualization of technology affordances in other settings. In addition, the timeframe of data collection was restricted. Thus, we were only able to capture a snapshot in time and were not able to track changes to the activity systems over time and their effects on EMR affordance actualization. Further research employing longitudinal case studies in hospitals and other settings is needed to provide additional evidence for the explanatory value of the activity-theoretical perspective on affordances. Such research may investigate adaptations of activity system elements intended to resolve contradictions and thus may increase the confidence in the mechanisms we have identified in this study.

5.3 Implications for Practice and Policy

This study provides further evidence that EMR usage patterns are related to the socio-cultural context of healthcare activities (Abouzahra et al. 2015; Fichman et al. 2011). Thus, when concerned with improving EMR usage to achieve expected outcomes such as improvements in patient safety and service quality (Gauld et al. 2014), policymakers and practitioners must consider the characteristics of the actor-environment systems. This study indicates that implementing an EMR must be accompanied by additional measures that target historical and emergent contradictions and stimulate change to multiple elements of the activity systems. In this regard, the findings of this study emphasize that the evolved conventions that govern collective healthcare activities need to be aligned with the benefits an EMR offers. As the empirical data provides evidence that EMR implementation benefits from the introduction of rules that stipulate meaningful use of electronically collected patient- and treatment-related data, adapting and adopting a meaningful use policy as the USA did could be a promising avenue for countries like Germany. However, such measures need to be accompanied by strategies that inform healthcare professionals' perspective on the value of data, both from a medical and a business point of view. On a related note, it could be beneficial to incorporate the managerial aspects of healthcare delivery and HIS usage into the curriculum and to incentivize professionals to attend corresponding in-house education programs.

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Paper IV

Operational Alignment in Hospitals

The Role of Social Capital between
IT and Medical Departments

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Paper V

How Social Capital between Medical and IT Professionals Shapes the Outcomes of Health Information System Implementation Endeavours

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Paper VI

How Do Project-Related Artefacts Qualify for Bridging Boundaries in IS Implementation Projects

An Activity Theoretical Perspective

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Paper VII

The “Known Unknowns”

Accounting for the Context and the Mediating Role
of IS in Implementation Projects.

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The “Known Unknowns”

Accounting for the Context and the Mediating Role of IS in Implementation Projects.

ABSTRACT

Boundary objects were found to significantly impact the outcomes of IS implementation projects. Despite emphasizing their flexibility, however, prior research is not very precise on the attributes that qualify project-related artefacts to become boundary objects. To identify the internal characteristics of artefacts that enable business and IT to synchronize IS and business needs, this research offers an activity theoretical view on boundary objects. The usefulness of the concept is demonstrated by means of an in-depth case study. The findings of this research emphasize that –in order to become boundary objects– project-related artefacts need to be part of the IS implementation and the business activity system. Moreover, they need to capture relevant knowledge of both activity systems and enable recognition of contradictions within and between. As to that, utilization of emerging project deliverables by means of internalization or externalization processes is found to facilitate the alignment between IS and business needs.

Keywords: IS Implementation, Context, Activity Theory, Case Study, Healthcare

1 INTRODUCTION

Imagine hospital employees who want to improve the efficiency of internal logistic activities by implementing a new information system (IS). The IS planning and implementation follows all textbook advice: prospective users are well involved, and all stakeholders explicitly support the project, participate in the requirements definition process and help to select an adequate IS. Once implemented, though, the hospital faces an IS implementation failure when the wards run into problems with issues such as short-term rescheduling at peak hours, which lowers process efficiency, e.g. when routing patients. What went wrong? An analysis reveals that the IS contradicts the organization’s cultural rules and division of labour that have developed over time and that are relied upon implicitly to deal with such issues, rendering established workarounds unworkable.

Research on information systems (IS) implementation success and failure is among the most prominent strands in IS research (Dwivedi et al. 2015). The literature and several ‘best practices’ taught in textbooks and applied in practice delineate success factors and support

IS implementation projects. Nonetheless, many projects fail (Dwivedi et al. 2014). As the vignette above illustrates, IS implementation must account not only for singular factors, but also for their interplay and particularly for the relationships between the known unknowns of the IS context and the technological artefacts embedded within it (Williams and Pollock 2012). Some scholars even argue that much of our contemporary IS implementation knowledge applied in practice is largely negligent of contextual particularities (Avgerou 2001). Williams and Pollock (2012), for instance, conclude that existing research on IS implementation tends to provide rather weak templates for understanding the full spectrum of complexities influencing the development, implementation, and use of IS.

In light of these limitations, we assume that research that accounts for the complexities of the context and illuminates the coevolution of existing activities and the technology employed will help to better plan and guide IS implementation. Furthermore, such research will likely increase professionals' ability to exploit the potential of IS. To enhance our understanding of IS implementation, we focus on frequently overlooked aspects of the context within which IS should be implemented (Hayes and Westrup 2012; Igira 2012). Two interlinked research questions guide our investigation:

- (1) What are the 'known unknowns' that contribute to the complexity of the context within which IS are embedded? And (2) how do these influence IS implementation success?*

To approach these questions, we develop a theoretical perspective on IS implementation that builds upon cultural historical activity theory (AT) and conceptualizes the context the IS is embedded in as the collective activity intended to be changed (Engeström 1987). This theoretical perspective then guides the analysis of data collected in multiple minor implementation projects related to an existing large-scale IS and helps to explain the sometimes quite unexpected outcomes of these projects.

Our findings reveal the importance of accounting for the context (i.e., the activity system) within which IS are embedded for implementation success. Our study's findings suggest that stakeholders should be mindful of the underlying tensions within the collective and contested activity systems that may trigger IS change and envision the role of the IS as a mediating tool within the pragmatic, historical, evolving and contested nature of work activities (i.e., the known unknowns). Overall, the study contributes to and complements existing literature by theoretically illuminating the aspects of the context within which IS are embedded that need to be considered during IS implementation projects. Moreover, the study reconfirms scant IS research showing that framing relevant real-world issues in light of AT enables IS research to better account for the context and conditions of IS interventions (Allen et al. 2013).

After a brief review of the literature on IS implementation, we work out the significance of the complexities of the socio-organizational context and show how AT accounts for these. We then develop our activity theoretical perspective on IS implementation and argue how this perspective helps us to rethink "what we are doing when we are implementing IT" (Dwivedi et al. 2014, p. 149). Next, we describe the research context and details of our methods. The main part of the paper then applies our theoretical understanding to the case study data to make sense of the outcomes of the implementation projects. In the concluding section, we synthesize our findings, lay out the contributions and discuss their implications for research and practice.

2 BACKGROUND

2.1 Prior Research on IS Implementation

There is a rich body of research that examines different facets of IS implementation. According to Bala and Venkatesh (2013), this research stream can be grouped into three interrelated categories: research on the implementation processes, on employees' reactions to novel IS, and on the impacts of IS implementation on firm performance. While the latter two categories examine the dependencies and effects of IS implementation on end users and the organization, the first research stream studies the interventions used to implement IS successfully (see e.g., Bondarouk 2006; Boonstra and Van Offenbeek 2010; Goh et al. 2011; Volkoff and Strong 2013).

Even though the recommendations provided by these research streams, such as the significance of user-involvement, top management commitment, and reengineering of business processes, “are widely accepted as common knowledge amongst both IS researchers and practitioners”, the failure rate of IS implementation projects is still far too high (Dwivedi et al. 2014, p. 149). IS implementation projects are commonly rated as failures if people involved are unable to create “a working or functioning system for the users” and the IS does not meet users' expectations (Ewusi-Mensah 2003, p. 7). In contrast, IS implementation is considered successful when the implemented system meets expectations regarding system and information quality and enables individuals to integrate the system within their practices and organizations to realize benefits from deploying it (DeLone and McLean 1992; Seddon 1997).

The underlying causes for implementation failure and success remain difficult to conceptualize, particularly since many projects fail even when best-practice approaches are followed. This is an indication that the common wisdom of IS implementation fails to account for “variations of the organizational and the broader context within which the innovation is embedded” (Avgerou 2001, p. 42). However, the definitions of IS failure and success as well as findings of current research emphasize the significance of the socio-organizational context in which IS implementation happens (Dwivedi et al. 2014). For instance, research on the impacts of IS implementation on firm performance shows that performance effects are contingent on functioning and aligned systems comprising the IS and complementary organizational resources, particularly human resources, work routines, and organizational culture (see e.g., Laumer et al. 2016; Malaurent and Avison 2015; Strong and Volkoff 2010; Sykes et al. 2014). Moreover, synthesizing relevant literature on employees' reaction to IS implementation, Laumer et al. (2016) reveal that interrelated aspects of the individual, the IS and the context contribute to IS implementation success or failure. Amongst others, self-efficacy (Klaus and Blanton 2010), the significance for and fit with work practices (Selander and Henfridsson 2012), and power and status (Lapointe and Rivard 2005; Lapointe and Rivard 2007) constitute objects of resistance that impact IS implementation outcomes significantly. Research considering the implementation process additionally reveals that measures such as user involvement, assignment of project champions, and top management support enable implementation of IS that meet user expectations, create functioning work systems and thus account for the socio-organizational context (Dwivedi et al. 2014).

Additionally, current research increasingly emphasizes the sociomateriality of human practice (Cecez-Kecmanovic et al. 2014; Orlikowski 2007; Orlikowski and Scott 2008). Amongst other findings, this research stream shows that, during IS implementation, established practices and practices inscribed in IS must be moulded together and that potential collisions between the social context and the IS need to be anticipated to achieve a working system for the users (Wagner et al. 2010). Hence, research proposes to actively manage the reciprocal moulding of context and IS to smooth out complex implementation efforts.

As laid out briefly, prior research on various aspects of IS implementation overall emphasizes the significance of the context into which IS are implemented. Moreover, research indicates that issues leading to IS implementation failure can only be meaningfully explained and eventually managed by considering contextual aspects (Allen et al. 2011; Heeks 2006; Igira 2012). Thus, enhanced understanding of the complexities surrounding IS implementation requires theoretically sound studies of IS in relation to the established practices of individuals within organizations (Avgerou 2001; Williams and Pollock 2012). Such contextual analyses would not only help academia to develop explanations for complex situations such as IS implementation failure but also increase practitioners' capacity to facilitate the exploitation of the potential of IS (Avgerou 2001; Schryen 2012). Since IS research is largely performed irrespective of contextual particularities surrounding IS implementation, there is a need for novel perspectives on IS implementation that account for the complexities of the socio-organizational context (Avgerou 2001).

2.2 Activity Theory as an Approach to Frame the Socio-organizational Context

Cultural historical activity theory or activity theory (AT) was developed to study artefact-mediated forms of human practice that are embedded in historical backgrounds. Though only a few IS scholars have applied AT, there is evidence that AT has the potential to enhance our understanding of the complex and dynamic socio-organizational contexts in which IS is implemented (see e.g., Allen et al. 2011; Allen et al. 2013; Igira 2012; Karanasios and Allen 2013; Karanasios and Allen 2014).

AT stems from the writings of Russian cultural-historical psychologists Vygotsky and Leont'ev starting in the 1920s. Following AT, a key characteristic of human activity is its collective, object-oriented and mediated nature (Engeström 1995; Leont'ev 1978; Vygotsky 1978). Object-orientedness means that human activity is always directed towards a concrete or abstract entity that moves from potential 'raw material' or 'problem space' to a meaningful shape that forms the outcome of the activity (Engeström 1999; Engeström 2001). The object motivates the collective activity, determines individual goals and actions within, and only takes shape and acquires its value by means of the activity (Engeström 2005; Engeström 1999). Mediation implies that humans do not directly interact with their environment. Rather, their actions and interactions are mediated using both cognitive and material tools that are empowered with experience and skills collected over time.

This tool-mediated relationship between the subject of an activity and its object, however, only reflects "the tip of an iceberg" (Engeström 1999, p. 66). The less visible mediators of the collective activity are the community, which encompasses all actors that revolve and

evolve around the object, as well as rules/norms and a division of labour, which inherently guide the actions and interactions of all actors involved (Kaptelinin 2005; Nicolini et al. 2012). The appearance of rules and division of labour indicates that the actions and interactions that constitute collective activity are “always, explicitly or implicitly, characterized by ambiguity, surprise, interpretation, sense making, and potential for change” (Engeström 2001, p. 134). Subsequently, AT emphasizes the complex and controversial nature of collective human activity, which is embedded in contested activity systems encompassing multiple mediating effects between subject, object, instruments, community, rules/norms and the division of labour.

Building on these ideas, Engeström (1987) proposed a scheme of activity that encompasses three interacting entities (subject, object, and community), which are mediated by cultural-historical tools, rules/norms and a division of labour (Kaptelinin et al. 1995). This so-called activity system illustrates the mediating effects between the elements of collective activity (see Figure 1), reflects the context within which people act and thus enables researchers to analyse the interaction between multiple actors, their tools and the social structures they are embedded in.

By combining tools and social aspects into one coherent framework, particularly bringing the use of technology into the realm of human activity, AT explicitly acknowledges the sociomateriality of human practice (Karanasios and Allen 2014). Rules, norms and a division of labour that developed over time govern the often contested relationships between the actors, regulate their actions and interactions and thus mediate the different perspectives and motives (Engeström 1987). Likewise, tools such as IT empower the actors with experience and skills collected over time.

A distinctive contribution of AT is its notion of contradictions that emerge within an activity. Activity systems always consider multiple points of view, traditions, and interests of actors, artefacts, rules/norms, and conventions (Engeström 2001) and are thus contested in nature. For instance, the patient as the object of healthcare activities may be considered as a person to be helped or as a source of revenue. AT introduces the concept of contradictions, which oppose “the overall motive of the system, the aim or purpose that subjects within the system are individually or collectively striving toward” (Allen et al. 2013, p. 840). These contradictions are best understood as tensions between components of activity systems. In healthcare, for instance, a contradiction might surface if physicians want to provide a patient with the most effective treatment, but the insurer constrains the physician’s choice if they will only pay for a more economical treatment. These tensions indicate misfits within or between elements of the system or different activities and “manifest themselves as problems, ruptures, breakdowns, and clashes” (Kuutti 1999, p. 34). Tensions “reveal inefficiencies and importantly, opportunities for change” (Karanasios and Allen 2014, p. 532) and are thus seen as the driving force for the development of human activities (Engeström 2001). Development of human activity, in turn, can be conceptualized as a process of resolving accumulated tensions within and between activity systems by modifying their elements (Cole and Engeström 1993).

2.3 An AT Perspective on IS Implementation

Building on the theoretical tenets of AT, we conceptualize IS implementation as the process of modifying one or multiple activity systems by introducing a novel IT artefact, thus, adapting the tools available within one or multiple activities. Following AT, the triangular activity system, its elements and the multiple mediating effects between the elements constitute the context within which IS are embedded. Moreover, we see emergent and accumulated tensions within activity systems as the driving force of IS implementation. Consequently, we understand IS implementation as the process of adding an IS to the tools embedded in one or multiple work activities in order to resolve tensions within and between these activities and thus to create a new developmental phases of the activities (Allen et al. 2013). Figure 1 summarizes or activity theoretical perspective on IS implementation.

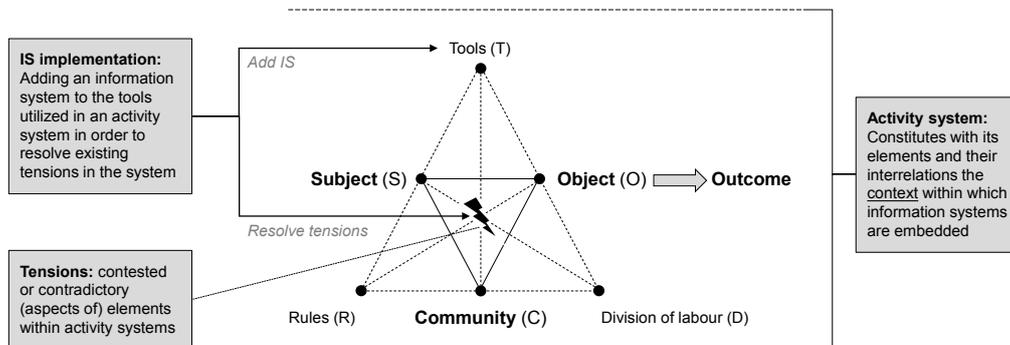


Figure 1: Activity theoretical perspective on IS implementation

Based on these considerations, IS implementation success is reflected in redefined and reconfigured activity systems with fewer tensions. Thus, successful IS implementation projects resolve or mitigate the tensions that triggered IS implementation and do not induce new tensions. If existing tensions are sustained or amplified even during what Burnes (2004) calls the end phase of the change (i.e., refreezing), which might show as user resistance or missed efficiency gains, IS implementation must be viewed as a failure.

Considering the origins of tensions that drive IS implementation, we agree with Avgerou (2001, p. 50) that “innovation inside an organization is rarely a result of its ‘free choice’ and action; it is to a large extent determined by events, trends, pressures, opportunities, or restrictions.” Consequently, we assume that tensions emerge or are aggravated due to changes to elements of the activity systems that may be triggered by external forces such as technological advances, policy, or competition. As a reaction to aggregated tensions within the activity system, individual participants begin to question the status quo, imagine how it may be aligned, and eventually subject elements of the system to change. As may be the case, the organization decides to reconfigure the toolset and implement an IS to resolve aggravated tensions. Recalling the introductory vignette, changing rules of fund allocation increase cost pressures on hospitals. Therefore, the objective of patient care is increasingly shaped by cost aspects which often contradict the historically dominant motive of healthcare activities to

treat patients in the first place. The tools that have evolved over time are increasingly incapable of providing the capabilities needed to achieve the desired outcome efficiently and fail to account for the way the division of labour has to be adapted or reconfigured. Thus, tensions within the activity system emerge. The case studies described later offer rich examples.

Using an activity theoretical lens on IS implementation enables us to investigate the complexity of human activity and the role of the IS within it. AT informs us that people engaged in IS implementation need to acknowledge that information systems function as mediating tools within a system of other cognitive and materialized tools, rules, and a division of labour. In addition, people involved in IS implementation projects need to consider that the activity systems intended to change reflect experience and skills collected over time and that they most likely inscribe divergent interests.

Informed by AT, we also expect that implementing novel or enhanced IS in activity systems that have evolved culturally and historically will not, per se, resolve tensions within these systems. Rather, stakeholders must identify the origins of the tensions and engage in collective change efforts aimed to adapt and synchronize the elements of the activity system, such as the IS and complementary organizational resources like tools and business processes (Lee et al. 2008). In this regard, we assume that the people engaged in IS implementation must acknowledge how the IS is produced by and produces human activity, which is mediated (i.e., manifest in complex systems), situated (i.e., located in time and space), provisional (i.e., constructed and constantly developing), and contested (i.e., characterized by domination and subordination) in nature (Blackler 1995). Through increased consideration of the nature of collective activities, stakeholders, artefacts, rules/norms, and conventions (Engeström 2001), implementation teams are expected to anticipate how the implementation of an IS may affect and is affected these activities. Without in-depth considerations of the activity systems, their elements and interrelations, IS implementation failure is more likely. We posit that analysing IS implementation with AT as a focal theory will enable us to identify aspects that contribute to the complexity of the context within which IS are implemented and eventually to understand how consideration of these complexities relates to IS implementation success.

3 METHOD

We use a multi-case study and the described activity theoretical perspective on IS implementation to disclose why some implementation projects succeed and others fail. More precisely, we analysed small implementation projects related to a large-scale IS within a German teaching hospital. Below, we give a brief introduction to healthcare as a research setting, present the research case in greater detail and discuss how we approached data collection and analysis.

3.1 Research Setting

Healthcare activities are complex and fragmented in nature (Greig et al. 2012). Delivering healthcare involves significant collaboration and coordination among an array of

professional disciplines, stakeholders and artefacts within a complex setting (Goh et al. 2011; Kannampallil et al. 2011). Actions and interactions of healthcare workers are governed by historically established and evolving social orders, which are, in turn, mediated and produced by relations of power, knowledge, and identity (Fichman et al. 2011; Halford et al. 2010). While some of these relations are apparent, others manifest only under certain conditions (Kannampallil et al. 2011). Furthermore, multiple cognitive and physical artefacts mediate these collective and contested activities by, e.g., fostering collaboration between the individuals involved in the activities.

To ensure quality and efficiency in healthcare within these complexities, information technology (IT) raises strong expectations (Goldzweig et al. 2009). Health IS such as Electronic Medical Records (EMR) are expected to increase the efficiency and quality of care by, for instance, improving coordination and collaboration (Erstad 2003; Greig et al. 2012; Hillestad et al. 2005).

Despite the envisioned benefits, shortcomings in the design and implementation prevent health IS from delivering on their promise (Kellermann and Jones 2013). The literature reveals that implementing health IS frequently disrupts healthcare activities and hence puts efficiency and quality at risk (Doolin 2004; Niazkhani et al. 2009). Implementing IT in a unique and complex domain like healthcare (Paul et al. 2012), which is increasingly influenced by regulation and competition, professionally driven, highly hierarchical, and multidisciplinary in nature (Fichman et al. 2011; Goh et al. 2011), is hence still seen as a major challenge (Kellermann and Jones 2013).

Since implementing health IS shapes and is shaped by numerous social and technical aspects of healthcare activities (Cresswell and Sheikh 2013; Kilsdonk et al. 2016), the healthcare domain seems to be ideally suited to investigate how consideration of the activity systems within which IS are embedded facilitates IS implementation.

3.2 Research Cases

The teaching hospital employs almost 8.000 people and provides health care services for approximately 400,000 patients per year. The primary IS of this hospital is its EMR. Supporting medical and administrative processes of healthcare delivery within and across all organizational units, the EMR is used in all clinics and departments of the hospital.

The implementation of the EMR within the hospital started approximately 10 years ago and first affected the work of most clinical and administrative staff within the hospital. Subsequently, resistance arose among end users because of misalignments with multiple facets of health care delivery that had developed over time. Numerous change management initiatives as well as adaptations to the EMR, mitigated much active and passive resistance in recent years. However, even today, existing and evolving misalignments, alterations of medical practices and recent developments such as technological and regulatory changes still lead to an abundance of requests to implement adaptations and extensions. Hospital management invests much effort to implement these continuous adaptations and extensions to the EMR to maintain it as fit-for-purpose and improve the efficiency of healthcare delivery by ameliorating tensions in various activities.

To manage these minor implementation projects, the hospital formed a steering committee comprising experienced medical stakeholders as well as IT staff. This committee evaluates all change requests, which are submitted by clinical stakeholders using a formalized document. This process follows documented best practices including user participation, joint requirements elicitation, and feasibility tests. Moreover, top management commits to every change that successfully passes the steering committee and signs off on its implementation.

To manage change requests, the central IT unit of the hospital employs a specific IS to store and manage data such as change-request documents, status information, requirements, meeting minutes, and other communication protocols. Analysing data provided by this tool, the research team selected 7 out of approximately 40 cases that were implemented within the time span of data collection. Adherence to best practices such as strong user involvement and the existence of a project champion as well as sufficient complexity of the adaptations/extensions were further inclusion criteria.

3.3 Data Collection and Analysis

Data collection took place between January and July 2015. For each implementation project, data on the pre- and post-implementation phases for each implementation project were collected (retrospectively for all cases except C3 and C4). We utilized multiple data sources and methods to ensure the reliability and credibility of the data (Miles and Huberman 1994) such as data from the management tool and semi-structured interviews with multiple stakeholders who are involved in and affected by the implementation.

Data gathered from the management tool enabled us to identify both IT staff and medical stakeholders involved in the changes. We asked at least one representative from both communities to participate in an interview. Following the suggestions by Yin (2009), the interviews were set up as semi-structured conversations. The interview-guideline contained open questions on the activity to be changed, the tensions that triggered these changes, and their outcomes. Moreover, it encompassed questions about stakeholders' consideration of the elements that constitute the activity systems and how they are interrelated, particularly the current and future role of the EMR within it (e.g., "*Are there any implicit rules that govern the activity?*"; "*How do these rules relate to the IS?*"; "*Did you consider these rules during implementation?*"). Each interview was audiotaped and transcribed. We re-questioned some of our interviewees to address further queries that emerged during other interviews and/or data analysis. Table 1 provides an overview of the interviewee's demographics and functional roles, the case mappings and interview durations.

Table 1: *Demographics, functional roles of interviewees, case mappings and interview duration*

ID	Function	Age	Gender	Case(s)	Interviews
IT01	EMR developer	46-60	F	C1	1 (50 min)
A01	Department manager	46-60	M	C1	1 (55 min)
N01	Ward manager (nursing)	46-60	F	C1	1 (30 min)
IT02	EMR consultant	46-60	M	C2, C3, C6, C7	2 (200 min)
N02	Ward manager (nursing)	31-45	F	C2	1 (50 min)
PH01	Senior physician	46-60	M	C3, C6	1 (115 min)
IT03	EMR consultant	46-60	M	C3, C5, C4	1 (50 min)
A04	Organ donor representative	46-60	M	C5	1 (55 min)
PH02	Senior physician	46-60	M	C6, C7	1 (45 min)
A05	Quality manager	46-60	M	C6	1 (70 min)
IT04	IT Manager	46-60	M	C1, C4	2 (45 min)
A07	Department manager	46-60	F	C4	1 (50 min)

To cross-check interviewees' perceptions and avoid bias concerning important elements of the activity systems and implementation success or failure, we complemented interview data with data from other sources such as minutes of project team meetings, correspondence between involved IT professionals and medical stakeholders, steering committee protocols as well as observations in discussions and casual conversations subsequent to implementation of the changes. Both the observations and findings of casual conversations were immediately recorded in a case diary. These data helped us to gain further understanding of the activity to be changed, develop problem and process descriptions, and collect information on how the change was executed, particularly how the affected activity systems and its elements were illuminated and considered from meeting minutes and written requirements. In total, we spent about two weeks on site and collected approximately 16 hours of interview material.

We took an interpretative perspective to make sense of the data, particularly to identify the aspects that constitute the complexity of the context within which the IS are embedded and how these relate to the outcomes of the implementation projects (Orlikowski and Baroudi 1991; Walsham 1995; Yin 2009). In line with Eisenhardt's (1989) recommendation to provide a priori specification of concepts that guide design and data collection, we reflected on recent empirical findings and developed an initial version of our activity theoretical perspective on IS implementation before analysing our data. Our interpretative approach to identifying relevant parts and giving meaning to data was structured by two analysis cycles. To discover theoretically grounded explanations, both cycles iteratively combined theoretical consideration, assumption development, data coding, and alignment of empirical patterns identified in the data with underlying theory (Walsham 1995).

The first cycle of data analysis was conducted parallel to the data collection. The primary aim of this cycle was to condense the material, to develop a full picture of the IS and the

affected activity and to identify relevant aspects of the socio-organizational context. To capture greater richness and foster confidence in the findings, data analysis was carried out as a team effort (Eisenhardt 1989). Following the guidelines of Miles and Huberman (1994), two researchers independently applied open coding to the transcribed interviews, documents, minutes and notes recorded in our case diary. The researchers constantly compared, analysed, and discussed the open codes to recognize inconsistencies and gaps and to integrate the codes into higher-level categories. When inconsistencies arose, the researchers reviewed the data and re-questioned the interviewees until the inconsistencies could be resolved. Once the data collection was complete, narrative case descriptions encompassing the aims, process and outcomes of the implementation project were created as a team effort. In the brief overview of the cases summarized in Table 2 below, columns two and five were derived from the case descriptions.

During the second cycle, we intensively analysed the coded data, identified connections between the categories and eventually created an AT-driven concept matrix (Miles and Huberman 1994). Amongst other information, the matrix covers management interventions, major aspects of the activity system affected by the implementation efforts, the tension(s) intended to be resolved, our assumption regarding the root cause of the tensions, the elements of the activity system that were considered during the implementation process, anticipated and resulting tensions, and an assessment regarding implementation success. Whenever findings or their interpretation differed, the cases were intensively discussed within the team until agreement on the contents of the concept matrix was reached (Miles and Huberman 1994). Columns three and four of Table 2 provide brief descriptions of the underlying tensions and our interpretation of the stakeholders' consideration of the activity system and Table 3 provides a condensed summary of the concept matrix. This matrix enabled us to identify patterns that helped us to better understand how changes and extensions to the EMR are successfully implemented (Yin 2009). To address coding bias and to improve the internal validity of our findings, the research team frequently discussed emerging patterns and checked them against theoretical assumptions provided by activity theory, as well as against alternative explanations. If necessary, initial assumptions were revised (Eisenhardt 1989).

Table 2: Brief description of the cases (tensions in square brackets)

ID	Activity, problem, and change request	Observed tension(s)	Consideration of the activity system	Implementation outcome
C1a	<i>Transportation of patients and material</i> is inefficient (e.g., long reaction times), requires workarounds of clinicians (e.g., requesting transports for multiple patients at once), and is insufficiently transparent (e.g., cost allocation). Transports within the hospital are requested by the wards (community [C]) and managed by a central logistics unit (subject [S]). A logistic information system to solve the issues was requested.	Inability of the central logistics unit (subject [S]) to comply with the directive to minimize costs for transportation of patients and materials between the wards and functional areas using existing toolset. Moreover, available tools limit the ability to increase transparency of cost allocation and fetch times (tensions within the mediating process between subject and tool [S-T]).	Considerations were limited to aspects related to the actions of the carriers (subject – tool [S – T]). Tensions between the carriers, the community, and the object were not anticipated, particularly how the novel tool disrupts evolved practices and workarounds developed over time in the wards (e.g., prioritization of transports, data-entry). Tensions between the community and tools [C – T] were considered and solved during rollout (hitherto labelled as C1b).	Staff in the wards refused to use the novel tool and requested transportation predominantly by phone. The tool limited the staff in the wards (community [C]) to react to ad hoc requirements/changes, particularly to coordinate with surgery schedule. After considering the interrelations with the community, emerging tensions were fixed by adjusting the tools and aligning capabilities of the tool with actions and interactions of the community (C1b).
C2	<i>Ward management</i> involves responsibility for optimized bed utilization. Changes to bed utilization conducted by physicians in the wards (community [C]) are hardly documented. Differences between scheduled and actual utilization cannot be easily detected, which inhibits ward mgmt.'s (subject [S]) goal attainment. Enhancement of EMR to provide detailed reports was requested.	The ward manager is not able to efficiently check for and document rescheduling (tension between subject – tool [S-T]). Directive to provide figures that reflect actual utilization contradicts implicit norm/culture that not documenting operational changes at the ward level is acceptable (tensions within rules [R]).	Considerations primarily involved aspects related to subject, tools and object; only marginal attention was paid to conflicting rules. Resolving the tensions between the implicit rules that govern the actions of the community (e.g., accepted approach not to document ad hoc rescheduling in the wards) and the directive to optimize bed utilization was not taken into account.	Ward mgmt. is enabled to manage (i.e., work around) conflicting rules and reach their goals. The enhanced EMR enabled ward mgmt. to reach their objectives, while sustaining variability on the ward. Implementation enables ward mgmt. to work around the root cause (conflicting rules [R]). This tension could not have been resolved easily.

ID	Activity, problem, and change request	Observed tension(s)	Consideration of the activity system	Implementation outcome
C3	<p>The <i>premedication</i> clinic is struggling with a rise in patient numbers, growing waiting times, and complaints by patients.</p> <p>The EMR does not allow clinicians to gather, analyse and minimize waiting times.</p> <p>Implementation of an extension to the EMR to manage waiting times was requested.</p>	<p>The EMR does not enable clinicians to optimize waiting times as requested.</p> <p>Staff at the premedication clinic are prevented from delivering their services efficiently (tensions within the mediating process between subject and tool [S-T]).</p>	<p>The solution considers all relevant activities that involve waiting time for patients within the clinic and avoids novel tensions between the increasingly important aspects of the object (i.e., patient satisfaction) and the existing division of labour [D-O], e.g. due to changes to the way tasks were always distributed between clinicians and administration</p>	<p>Intended objectives could be reached.</p> <p>Implementation of the changes to the EMR enable medical management to gather and analyse waiting times.</p> <p>No unintended consequences such as resistance or other tensions were observed.</p>
C4	<p>Patients need to explicitly agree or disagree with <i>using their biomaterial for research</i> (written consent).</p> <p>The process of collecting the consent is not standardized and the paper-based consent form or status of consent is not readily accessible to researchers (they must call the ward that took the tissue).</p> <p>A process for managing patient consents within the EMR was requested.</p>	<p>Inability of researchers to pursue their studies efficiently since they must ensure patient consent for using biomaterials (tensions within the mediating process between subject and tool [S-T]).</p>	<p>Stakeholders agreed that a standard process needs to comply with data protection laws and fit with varying practices in the wards/departments</p> <p>The risk of novel tensions by, e.g., anticipating tensions related to the divergent perspectives on patient consent by researchers and physicians at the wards and the history of how tasks are distributed was mitigated [D-O].</p> <p>How the IS affects the division of labour and rules, took measures to mitigate workload shifts, and ensured adaptability to local requirements was considered.</p>	<p>The enhanced EMR enables researchers to efficiently ensure and document patient consent.</p> <p>The workload of the clinicians in the ward increased only marginally.</p> <p>Creating awareness for tensions between the existing division of labour and the collective objectives paired with cautious redesign of the way tasks are distributed within the activity system reduced resistance to collecting consents at the wards (reduced tension between [C-D-O]).</p>

ID	Activity, problem, and change request	Observed tension(s)	Consideration of the activity system	Implementation outcome
C5	<p>Organ donor standards were updated and the directive that all physicians within the ICUs comply with organ donor standards was reinforced. Amongst other requirements, physicians need to involve an organ donor representative and report organ donor statistics (<i>medical documentation</i>). To increase physicians' compliance with the standards, updated organ donor documentation forms were requested.</p>	<p>The EMR did not comply with the latest/future organ donor standards (tensions between rules and tools [R-T]). Clinicians were thus not able to comply with the standards (tensions within the mediating process between subject and rules [S-R]).</p>	<p>Stakeholders only superficially considered that the updated standards (i.e., updated documentation forms [T]), but also require them to involve an organ donor representative (i.e., division of labour [D]). The norm at the ICUs to skip the form (i.e., implicit norm [R]) and physicians' limited interest in involving a representative (increased effort) was not taken into account. Thus, it was not recognized that further measures are necessary to increase compliance.</p>	<p>Changes to the EMR enable the clinicians to comply with the new standards. Implementing the adaptations to the EMR did not increase adherence to organ donor standards; physicians still resist using the new documentation forms and thus complying to the rules [S - R]</p>

ID	Activity, problem, and change request	Observed tension(s)	Consideration of the activity system	Implementation outcome
C6	<p>Aiming to improve patient safety in surgery, the federal self-government committee adopted a directive that hospitals need to implement the WHO safety checklist (covering premedication, post-anaesthesia care and other areas).</p> <p>A mandatory process in the EMR as a replacement for the paper-based checklist was requested by hospital's quality board.</p>	<p>Existing tools are not able to enforce the use of the safety checklist (tensions between rules and tool [R–T]).</p> <p>The directive to apply the safety checklist contradicts the implicit rule that surgeons decide what needs to be done (tensions within rules [R]), which causes tensions between (senior) surgeons who have little interest in applying the checklist and the nurses who see much advantage (tension between subject and community [S–C]).</p>	<p>Stakeholders agreed that implementing the safety checklist within the EMR must not negatively affect workload and division of labour within the surgery [D–C] and hence adopted appropriate measures.</p> <p>Implicit rules/culture within the surgery were not considered [R] (surgeons are in charge during the surgery; all others must obey).</p>	<p>Tool-replacement did not lead to consistent use of the safety checklist nor a changed culture in surgery.</p> <p>The safety checklist is still skipped by senior surgeons by using a workaround (resistance to using the tool).</p> <p>Heightened tensions between (senior) surgeons and healthcare assistants [S–C].</p>
C7	<p>Because of various changes within the EMR and related systems, flexibility in the <i>preoperative planning</i> processes is restricted. In particular, patients cannot be rescheduled once premedication has started.</p> <p>Central surgery thus requested to adapt the EMR to regain flexibility without losing the advantages of prior changes particularly for the anaesthetists and healthcare assistants.</p>	<p>Prior adaptations to the EMR created tension between the mediating process between subject and tool [S– T]): the evolved EMR obstructed preoperational planners to operate on patients as efficiently as possible while ensuring patient safety and meeting documentation requirements.</p>	<p>The stakeholders anticipated possible tensions between the community and the tool and avoided them, particularly regarding the stability of practices of anaesthetists and healthcare assistants (tensions within the mediating process between the community and the tools [C– T]).</p>	<p>Adaptations to the EMR enabled the preoperative-planning team to increase their efficiency.</p> <p>Novel tension within the wider activity system, particularly related to the community (e.g., surgeons, perfusionist, anaesthetists, healthcare assistants, etc.), were anticipated and avoided.</p> <p>Subsequently, no unintended consequences were observed.</p>

4 ANALYSIS AND FINDINGS

The analysis revealed that the implementation projects were initiated to tackle contextual issues that reveal inefficiencies within activity systems. Stakeholders in the activity system (i.e., either the subject or community) either perceived that available tools limited their productivity (C1, C2, C3, C4, and C7) or inhibited them to comply with changing rules and evolving division of labour efficiently (C5 and C6). Particularly, they found the EMR inhibiting them from approaching emergent, increasingly important but also contested aspects of the object of their collective activities efficiently.

An analysis of underlying tensions reveals that the limitations of the EMR unfolded as other elements of the activity evolved over time. For instance, the increased importance of quality assurance mechanisms led to various changes to the EMR, which, in turn, significantly limited pre-operational planners' ability to respond efficiently to last minute changes in the operation theatre (C7). Though healthcare professionals' actions are still directed toward the wellbeing of patients, they must increasingly respond to cost accounting and service quantification. Consequently, several tensions within the activity system and its elements aggravated and surfaced as disturbances and breakdowns. For instance, the hospital's board and medical stakeholders called for increased efficiency of patient and material transports within the hospital (C1). However, the available tools offered only limited support for managing transportation requests.

The IS implementation projects we analysed were set up to reconfigure the available set of tools to overcome these limitations. Below we present our analysis in greater detail and exemplify the complexity of the contexts for some cases by analysing the activity systems and how the implementation team considered and approached the tensions within these systems.

4.1 Seeing Beyond Inefficiencies

Although the tensions led healthcare professionals to initiate adaptations to the toolset, particularly extensions to the EMR, most tensions were not resolved by simply implementing new or enhanced IS. In search of patterns that distinguish failed (C1a, C5, and C6) from successful projects, we found that the implementation teams of failed projects only superficially considered aspects beyond the limitations of the EMR. Particularly, the stakeholders insufficiently considered how the EMR, explicit and implicit rules governing actions and interactions of the people involved in an activity, and their impact on the way tasks are distributed interact with and relate to the inefficiencies they intend to overcome.

For instance, C6 aimed at implementing a board directive to enforce the use of the WHO safety checklist in surgery by means of the EMR. The quality manager triggering this change assumed that the existing paper-based safety checklist was unable to facilitate the mandatory use of the checklist and therefore requested implementation of the checklist as a compulsory process within the EMR. However, our analysis shows that the resistance to using the safety checklist exactly as intended is not only related to the paper-based form of the tool, but also to the culture in operating room. Statements of senior physicians in reaction to nurses'

requests to complete the checklist like “*just click through all these items, we are not filling out the questionnaire now, I think that’s useless anyway*” (according to PH01) or “[*checklists*] *contradict the fact that medicine is extremely individualistic and unstandardized, and that people are proud of it*” (PH01), indicate that not the shortcomings of paper-based forms but rather unwritten rules contradict management directive to use the checklist. Even after the mandatory checklist was added to the EMR, senior physicians still found ways to skip it. Moreover, the tensions between nurses who requested adherence to the checklist and physicians who wanted to skip it intensified. C1a and C5 reveal a similar pattern. The people involved in C5, for instance, only superficially considered that not only modifications to the EMR, but more importantly, impacts on the distribution of tasks and effort and existing norms at the ICUs determine adherence to the standards.

In contrast to C5 and C6, C2 was at least partly successful. C2 concerns ward management, who became gradually responsible for managing the cost of healthcare delivery by, amongst others, optimizing bed utilization. Ward management found it difficult to accomplish this management request until physicians were explicitly required to document ad-hoc rescheduling. According to our informants, physicians “*are overloaded with administrative tasks – they seem to lack time for further documentation*” (N02). The socially accepted shift of tasks toward ward management contradicts the request to optimize bed utilization. The implementation team recognized this tension, but did not aim to resolve it. Rather, they implemented an extension to the EMR that eventually enabled the ward manager to deal with the tension more efficiently. However, in order to solve the tension, hospital management would have had to align ward managements’ responsibility for optimizing bed utilization and the norm that physicians do not need to document ad hoc rescheduling. Building on our analysis, this would have only added little effort for physicians, but would have significantly facilitated optimizing processes. Though changes to this implicit rule that solidifies the division of labour at the wards cannot be easily implemented, addressing this tension might be unavoidable if the ward’s responsibility for improving profitability increases further.

Analysing these patterns reveals that C5, C6 and C2 are characterized by a mismatch between the issues that motivated stakeholders to implement changes to the EMR and the tensions that caused large parts of the issues they intended to resolve (see Table 3). As Table 2 and Table 3 show, the pattern concerning the successful implementation project is quite different. Here, the implementation team managed to identify and approach the tensions that surface as inefficiency. Thus, there is evidence that the ability to identify and account for underlying tensions enables people involved in IS implementation to effectively reach their objectives. Moreover, it seems to be much easier to identify tensions related to inabilities of the tools available within an activity than tensions related to rules and norms that govern actions and interactions of individuals within an activity.

Table 3: Changes to activity systems, consideration of elements and effects

ID	Implementation success	Tension intended to resolve	Underlying tension	Considered AS elements						Anticipated tensions	Remaining /resulting tension
				S	O	T	R	C	D		
C1b	Yes	C – T		●	●	●	●	●	●	-	-
C3	Yes	S – T		●	●	○	●	●	●	D – O	-
C4	Yes	S – T		○	●	●	●	●	●	D – O	(D – O)
C7	Yes	S – T		●	●	●	●	●	●	C – T	-
C2	Yes, with W	S – T	R	●	●	●	○	●	●	-	R, (S – C)
C1a	No	S – T		●	●	●	○	○	○	-	C – T
C5	No	R – T	S – R	○	●	○	○	○	○	-	S – R
C6	No	R – T	R	●	●	●	○	○	●	C – D	R, S – C

○ not or only very superficially considered, ○ partly considered, ● thoroughly considered
 S= Subject; O = Object; T = Tools; R = Rules; C = Community; D = Distribution of Labor; W = Workaround; Minor tensions are parenthesized

4.2 Considering the Mediating Role of the IS within an Activity

As depicted in Table 3, our analysis also reveals that successful implementation projects are characterized by in-depth consideration of the complexities of the context. People involved in successful IS implementation projects carefully considered how introducing a novel IS might affect and be affected by other elements of the activity system and anticipated unintended consequences of changes to the interrelations between the IS and socio-cultural elements (i.e., rules and the division of labour).

For instance, IT and healthcare professionals responsible for C4 analysed the mediating effects of the IS beyond its primary users and their objectives. Discussions with clinicians revealed that additional documentation for biomaterial consent will most likely lead to strong resistance at the wards. The implementation team thus deliberated on how to adapt the EMR to increase efficiency while –where feasible– preserving the division of labour that developed over time and that governs the interactions of researchers and physicians in the medical departments. Taking into account the wider activity system enabled them to anticipate that disruptions related to division of labour within the wards may endanger the objective of IS implementation. The people involved understood that the IS to be implemented must account for the interests of the physicians in the wards, who are the most powerful stakeholders of the bio bank and very sensitive to administrative workload (“we will try to make the extra work for physicians as moderate as possible” – IT04). Thus, they took preventive organizational measures aimed to get the medical directors involved in the decision, convinced them that making the consent status easily accessible is critical, and that accessibility requires slight adaptations to the division of labour. Eventually, they agreed that implementing the IS and related workflows must not significantly impact the division of labour and that particularly shifting administrative effort to the physicians at the wards must

be avoided. The implementation team thus advocated for integrating the IT-enabled collection of patient consents during patient admission. However, this approach ignored rules set by the hospital's ethics commission, which rejected this suggestion. Further discussions helped IT and healthcare professionals to take into account diverging norms at the wards concerning the interaction between healthcare professionals and patients and how those characterize the distribution of tasks. Eventually, the enhanced EMR accounts for both the heterogeneous local requirements and the prerequisites of the ethics commission and thus mitigated the emergence of new tensions.

Similarly, the implementation teams responsible for C2, C3, and C7 did not limit their considerations of the future role of the EMR to the relationship between the users that triggered the change and their perspective on the object of the collective activities. They—at least partly—anticipated the impacts of the changes to the EMR on multiple mediating effects in the activity system. In contrast, IT and healthcare professionals involved in C1 initially failed to recognize that implementing changes to the toolset would also affect existing conventions currently governing the interplay between the various parties involved in the activity (C1a). For instance, they did not consider that the central surgery theatre often reschedules patients on short notice in the morning (e.g., due to an emergency). Once the logistics information system (LIS) was rolled out, the surgery planning team ordered transportation via the EMR extension. Due to increased efficiency of transportation handling, a logistics person was soon at hand to transport a patient to the operation theatre. Since the nurses at the wards are usually busy in the morning and are not sitting in front of the computer, they did not realize that a patient's surgery time had been moved up by the surgery planning team and did not prepare the patient. This led to several disruptions at the wards and tensions between the nurses and the LIS, and they increasingly resisted using it. An analysis of the interaction with the novel tool revealed that before rolling out the LIS, the implementation team had disregarded the role of the central logistics office, which called the wards when they needed to prepare patients in the morning and in case of emergency. Since the LIS automatically handles transportation requests, this workaround was rendered impossible. Moreover, the blood bank requested that the LIS requires nurses to key-in the birthday of the patient when they order a blood bag. This enables them to ensure that they dispatch the correct blood bags. However, looking up the birthday and keying it in caused additional effort for the nurses, which created stress particularly in case of emergency or during surgeries. Aligning the EMR and LIS with these shifts in task distribution (e.g., data entry) and conventions and workarounds (e.g., transportation orders in the morning), such as by automatically adding birthdates and enabling workarounds at peak times (C1b) resolved these tensions (see Table 3).

In contrast, C6 shows that ignoring social structures that develop over time and govern the actions and interactions of activity system members increases the risk of IS implementation failure. On the one hand, the implementation team engaged in C6 understood implementing extensions to an IS to govern the actions of the surgeons, the premedication team, the perfusionists and healthcare assistants affects the way tasks are distributed within the operation theatre. Moreover, they realized that applying the checklist is more strongly aligned with the perspective of non-physician clinicians on the general objective of the activity than with surgeons' perspective. The latter perceive the checklist as an annoying delay of surgery and as an additional administrative task, rather than as something that could help them to

treat the patients better. Thus, the implementation team put an emphasis on implementing extensions to the EMR that enable involved parties to apply the checklist without much additional effort. On the other hand, the team did not consider that the culture within the surgery, particularly the norm not to challenge the authority of surgeons (an implicit rule at the operation theatre with a long-standing tradition) has the potential to reinforce tensions between the perspectives and motives of surgeons and non-physician clinicians, and hence may offset the advantages of implementing an easy-to-use checklist. Rather, the implementation team assumed that the implementation of the checklist within the EMR would enable the nursing staff and quality management to emphasize the application of the checklist more strongly, which would then lead to greater utilization. However, the team underestimated the mediating effect of implicit rules and overestimated the role of the novel IS. Rather than diminishing the impact of the culture in the operation theatre by implementing mandatory IT-enabled processes, the interplay between these implicit rules and IS reinforced the tensions between surgeons and non-physician clinicians.

5 DISCUSSION AND CONCLUSION

Though the findings of this interpretative multi-case study need to be tested in other settings (Lee and Baskerville 2003), they show how our activity theoretical perspective on IS implementation helps broadening our way of thinking about IS implementation projects and sharpen our focus on relevant aspects of human activity. Empirical data supports our theoretical argument that IS implementation commonly aims at resolving issues caused by tensions within or between elements of activity systems that have developed over time. Concerning our first research question, our analysis also reveals that the activity system concept and the notion of tensions within these systems captures the complexities of the context within which IS are embedded. Moreover, it is indicated that the complex interplay of cultural-historical conventions constituted by rules/norms and the division of labour as well as divergent perspectives on the object of IT-mediated activity have a high chance of being overlooked during IS implementation. Regarding our second research question, our study provides evidence that the degree to which implementation teams were aware of and considered these frequently overlooked aspects of the activity systems that are targeted by IS implementation clearly distinguishes those projects that achieved their objectives from those that did not.

Overall, our activity theoretical perspective on IS implementation illuminates the ‘known unknowns’ that contribute to the complexity of the context within which IS are embedded and thus enhances our theoretical knowledge about the process of IS implementation (i.e., resolving tensions within activity systems). Consequently, the perspective opens avenues for further enrichments of established IS project management techniques such as stakeholder analysis and requirements elicitation (Boonstra et al. 2008; Pitts and Browne 2007). Below we discuss the contributions and implications of this research in detail.

5.1 Framing the Context and its Complexities

AT emphasizes the complex and controversial nature of collective human activity, which is materialized in contested, situated and provisional activity systems encompassing multiple mediating relations between and within the elements of these systems (Engeström 2001). Taking this theoretical stance and understanding IS implementation as a process that aims at resolving problems caused by tensions within or between elements of these systems draws attention from individual, tool-mediated actions to the interplay among multiple actors, often implicit rules/norms and divisions of labour that govern their actions and interactions, cultural-historical aspects of these elements as well as the role of IS within these complexities. Though AT is more of a descriptive meta-theory than a predictive theory, its notion of activity systems enabled us to identify significant aspects of the context and to provide evidence for how taking these into account increases the chance for implementation success. Table 4 summarizes the aspects that contribute to the complexity of the context that can be derived from AT and our analysis. Since our limited understanding of the type and nature of contextual particularities surrounding IS implementation has been identified as a major weakness in IS implementation research (Avgerou 2001; Dwivedi et al. 2015; Williams and Pollock 2012), this research provides a significant theoretical contribution. Below we discuss how taking into account these aspects enables IS implementation teams to design and implement systems that resolve tensions within collective activities without creating novel ones.

Table 4: *Categories of ‘known unknowns’ we have identified using activity theory*

Observed aspects that contribute to the complexity of the context	Questions that enables people involved in IS implementation projects to account for the complexities of the context
Human activity is characterized by different and often contested perspectives on the object of the collective activity, particularly concerning historical and emergent aspects that determine individual goals (i.e. it is contested)	<p>Which perspectives on the object of the collective activity coexist?</p> <p>(How) does the IS need to account for the different perspectives? Does it over-emphasize a single perspective? Does the IS reinforce contradictions between divergent perspectives?</p> <p>Does the IS limit other members of the activity system (i.e., the community) in achieving their objectives, particularly less visible aspects of the object?</p>

Observed aspects that contribute to the complexity of the context	Questions that enables people involved in IS implementation projects to account for the complexities of the context
Human activity is manifest in systems of tools, rules/norms and a division of labour, which cannot be considered in isolation (i.e., it is mediated)	<p>Which tensions within these systems need to be resolved or mitigated prior to IS implementation?</p> <p>What are important conventions (e.g., implicit and explicit rules/norms, divisions of labour) and tools that mediate interests, traditions, actions and interactions of individuals and communities? How do they interrelate (e.g., are there conflicting rules)?</p> <p>(How) will these mechanisms be affected by the IS (e.g., reinforced, contradicted, etc.)?</p> <p>(How) will the IS challenge these mechanisms, particularly those that are important for individual interests (e.g., evolved workarounds)?</p>
Collective activity enacted over time and in places reflects its history and is specific to particular contexts (i.e. it is situated)	<p>Are there conventions that reflect the history of the activity (e.g. culture)? Do these conventions contradict current developments (e.g., novel regulations and technical advancements)?</p> <p>(How) will the IS interact with these historically evolved and emergent conventions?</p> <p>Does the IS account for local variations of the activity, particularly regarding the rules/norms and differences in the way tasks are distributed?</p>
The role of the IS is, like human activity, constructed and constantly developing (i.e. it is provisional)	<p>Is the IS able to resolve or mitigate tensions that developed over time (e.g., offer ways to deal with contradictory rules by means of workarounds)?</p> <p>(How) is the IS able to deal with ambiguity of actions and interactions of individuals/communities?</p>

5.2 Significance of Contextual Complexities

The theoretical deliberations and empirical evidence of this study stress that implementing a novel IS within complex organizational settings not only implies changes to the toolset employed but also affects multiple and complex mediating relationships within activity systems. IS implementation is often triggered by the limitations of existing tools to comply with existing rules/norms easily or to realize expected outcomes of collective activities efficiently. However, the ability of the IS to increase efficiency and thus achieve its implementation objectives is not only contingent on its form and function, but rather on the interplay between and within the elements of collective activities that developed over time. A major contribution of this research is thus to delineate the space within which IS is implemented by bringing into play the activity system and the complexities it produces. This research also provides evidence that taking into account how a novel IS will impact the

systems of tools, rules/norms and a division of labour, particularly how the IS affects or is affected by tensions within these systems is critical for IS implementation success.

In line with deliberations on sociomateriality, the activity theoretical lens on IS implementation developed in this paper also stresses the inseparability of IS and the collective activities in which they are embedded (Matthew R. Jones 2014). Human and organizational activities are increasingly dependent on IS, though members of activity systems are frequently not aware of the complex mediation processes related to the IS intended to be implemented.

Acknowledging the inextricable entanglement of the social and the material (Orlikowski and Scott 2008), the findings of this research show that AT provides theoretical and analytical concepts that can be leveraged by research and practice to advance the design, implementation and use of technologies. Particularly, the theoretical concept of contradictions and tensions within activity systems that developed over time and cause inefficiencies has the potential to further enhance our understanding on IS implementation. The research already indicates that implementation teams need to account for actual contradictions and tensions and anticipate if and how material aspects of the novel IS (i.e., its form and the functions it provides) may amplify existing tensions or cause novel ones. Considering the tensions and identifying how the IS is affected by and affects these tensions was found to significantly influence the ability of implementation teams to design and implement IS that enables key-players and related parties to increase the efficiency of their collective activities. Further research may, for instance, identify factors and mechanisms that enables IS implementation teams to develop this capability.

5.3 Oscillating between Levels of Analysis

Employing activity systems as the primary units of analysis, the focus of the current research goes beyond the isolated human being (Allen et al. 2011) and his or her individual needs for and responses to IS implementation as frequently applied in examining IS implementation success (DeLone and McLean 1992; Devaraj and Kohli 2003; Dwivedi et al. 2014). Notably, our view on IS implementation emphasizes and illuminates the macro level of the collective (i.e., the context), while acknowledging the importance of individual actions that are produced by and produce the context. We show that IS implementation must not aim merely to ensure optimal “fit between a system and employees’ job” as reflected by ease of use and usefulness perceptions (Venkatesh and Bala 2008, p. 304). Rather, introducing IS within activity systems also needs to consider the cultural historical aspects of the collective activity, which, in turn, produce these perceptions. We show that taking an AT perspective on IS implementation allows us to account for the collective, pragmatic, situated, provisional, and contested nature of human activity and examine individual actions that produce and are produced by the activity systems as well as their interrelations. Using the methodological tools that AT offers to investigate collective activity and individual cognitions and actions within, further research may oscillate between micro and macro-levels of analysis and thus come up with richer interpretations of IS implementation (Jensen et al. 2009). Such an approach could be particularly useful for exploring employees’ reactions to novel IS and its impacts on organizations, e.g. when investigating employees’ ease-of-use and usefulness perceptions as well as resistance to change.

In line with recent research on resistance during information systems implementation (see e.g., Laumer et al. 2016), this paper also demonstrates that factors that may lead to resistance to change, such as perceptions of power, produce and are produced by culturally specific activity systems that have developed over time. Our findings provide evidence that resistance towards novel IS, for instance, may result if individual members of the activity system perceive the IS as emphasizing single points of view, traditions, interests, and related conventions rather than solving tensions within collective activities. To this end, further research may apply our activity theoretical perspective on IS implementation and the conceptual tools AT provide to tackle theoretical questions related to resistance to IT-induced change. Such research may, for instance, draw on the notion of tensions between material aspects of the tools and the social aspects of activity systems and their manifestation in breakdowns and ruptures.

5.4 Managerial Implications

As laid out above, our findings indicate that taking into account aspects that contribute to the complexity of the context increases chance for successful IS implementation. Consequently, implementing IS requires overcoming the short-sightedness of actors considering technical tools only as enabling individuals to approach their goals. Our analysis indicates that considering only the primarily acting persons/communities and their perceptions of the usefulness of the tools they utilize is necessary but not sufficient. Past studies indicate that best practice measures such as stakeholder analysis, getting buy-in from users, having a project champion and understanding the user requirements (Boonstra et al. 2008; Dwivedi et al. 2014) can facilitate the design of IS that are perceived as efficient mediators between individuals and their objectives. However, our analysis also indicates that these measures do not ensure that IS implementation will lead to a workable system on the collective level. Thus, managerial interventions and best practices surrounding IS implementation should not be aimed merely to influencing ease of use and usefulness perceptions but also toward increasing awareness of the collective activity system.

The activity theoretical perspective on IS implementation developed in this paper may help to enhance established requirements engineering methods that enable analysts to understand critical requirements. These methods have a strong focus on individual perspectives on the goal of IS implementation, difficulties and constraints, relevant tasks as well as on information needed (Pitts and Browne 2007). To widen the focus, prior research argues for the use of strategies like scenario building, elaboration and counterargument. The activity theoretical lens on IS implementation will hopefully help practitioners to improve these techniques and enable analysts to identify ‘known unknown’ aspects of the collective activities concerned by IS implementation.

The second column of Table 4 proposes some questions that either helped implementation teams in our study to illuminate aspects that contributed to the complexity of the context or may have helped them. These questions may broaden the focus of people involved in IS implementation from impacts of the IS on their actions and interactions to the cultural-historical aspects of the systems within which their actions take place. In line with prior research, we assume that visualizing techniques such as creating value-stream maps or work system representation stimulate discussions beyond the informational and technical

requirements of individuals (Alter 2008; Wagner and Weitzel 2012). Overall, considering the concepts of AT may help practitioners to create and perform activity checks aimed to identify potentially relevant contextual factors and to ensure that involved users consider aspects that contribute to the complexity of the context, to identify tensions and develop strategies to resolve them (Sadeghi et al. 2014).

5.5 Limitations

As with any study of this nature, our study is limited in certain ways. First, the data were collected in a single large hospital in Germany and cover a limited time span of seven months. Second, while improving comparability, the sample size of seven cases sharing a similar technological and organizational background limits the potential for generalization. However, as this paper aims to generalize from theoretical to empirical statements, it still offers some valuable contributions to academia and practice (Lee and Baskerville 2003). Third, we were only able to collect data on the activity systems prior to IS implementation retrospectively. Fourth, the time span at our disposal for evaluating whether implementing the IS helped to mitigate structural tensions within the activity system was admittedly short, particularly considering the interplay between the IS and historically evolved elements of an activity (e.g., implicit norms). To verify our theoretical and empirical insights, further research might employ multiple longitudinal case studies in various organizational settings and cultures.

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Paper VIII

The Unintended Consequences of Insufficient Shared Understanding

An Activity Theory-Based Framework
to Guide Health IS Implementation

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The Unintended Consequences of Insufficient Shared Understanding

An Activity Theory-Based Framework to Guide Health IS Implementation

ABSTRACT

Information systems (IS) scholars agree that shared understanding facilitates the implementation of IS and can prevent unintended consequences but lack clarity about the areas in which shared understanding is needed. Taking an activity theory perspective, this paper theorizes that shared understanding is needed about knowledge, experiences and perspectives on the contested nature of collective work practices that are affected by IS implementation. Analyzing data collected in two case studies, we find that issues emerging during implementation can be traced back to a lack of shared understanding of the activity systems affected by the new IS. We also find that it is critical to have shared understanding about how the IS relates to contradictory motives, rules and the division of labor that evolve over time. We synthesize these findings into a framework connecting the elements of activity systems about which shared knowledge is needed to avoid unintended consequences and, ultimately, IS implementation failure. This study guides the course of IS implementation projects and facilitates the creation of shared understanding of the role of the IS, specifically in healthcare activities, to help avoid unintended consequences.

Keywords: Health IS, Implementation, Shared understanding, Activity theory, Hospital

1 INTRODUCTION

Society expects a great deal from health information technology (IT), particularly concerning the quality, safety, and efficiency of healthcare (Jones et al. 2014). Imagine a hospital implementing a health information system (HIS) to fulfill these expectations. Even though its management follows textbook approaches (Cresswell and Sheikh 2013; Cresswell et al. 2013), unintended consequences such as dysfunctional workflows and resistance can arise and threaten the project's success.

IS literature reveals that this scenario is common, and that IS implementation, and HIS implementation in particular, regularly disappoints users and stakeholders (Cresswell and Sheikh 2013). Implementing information systems (IS) able to overcome the difficulties inherent in healthcare domain and its various stakeholders remains a major challenge (Kellermann and Jones 2013). This may be attributed to contradictory characteristics of the healthcare environment (Cresswell and Sheikh 2013). For instance, healthcare work is embedded in a multi-stakeholder environment characterized by strict hierarchies and professional autonomy, influenced heavily by governmental regulation and the need for local variations, as well as altruistic and monetary motives (see e.g., Fichman et al. 2011).

Prior research indicates that the successful introduction of IS in such a complex environment depends on a variety of social and technical factors (Cresswell and Sheikh 2013; Kilsdonk et al. 2016). To identify and account for these factors, the idiosyncratic knowledge, experiences and perspectives of stakeholders and those affected by HIS implementation must be shared and integrated, i.e. shared understanding must be developed. Though prior research shows that such shared understanding enables interdisciplinary teams to implement IS effectively (Charaf et al. 2013; Tesch et al. 2009), there is a lack of clarity about the areas in which shared understanding is needed (Bittner and Leimeister 2014).

To guide implementation of HIS that are better able to meet expectations and improve outcomes, it is thus valuable to gain deeper understanding of the perspectives, knowledge, and experiences that people involved and affected by HIS implementation need to share, integrate and agree on. Thus, our research question is: *In what areas is shared understanding needed to avoid unintended consequences during HIS implementation?*

To approach this question, we interpreted data collected during two HIS implementation projects in a large German hospital. Grounded in Activity Theory (AT), we developed initial assumptions about areas of healthcare work and knowledge that need to be recognized, shared, and considered during HIS implementation. AT informed our understanding of the elements of healthcare work that are affected by HIS implementation, the significance of diverse perspectives, and the role of HIS as a mediating instrument. The assumptions derived from AT were constantly refined during this process. By iteratively interpreting our data and refining the theoretical concepts, we develop a coherent explanation of unintended consequences that emerged during and after the rollout of the HIS. These explanations informed the development of a framework, which points to areas in which a shared understanding is needed to avoid rollout problems. Before we lay out our theoretical stance, we briefly discuss the complexities of HIS implementation and introduce the concept of shared understanding.

2 THEORETICAL FOUNDATION

The delivery of health care in hospitals is subject to extensive regulation, influenced by strict hierarchies, and multidisciplinary in nature (Rohner 2013). In the face of such complexities, health care actors need a highly reliable HIS that is adaptable to local variation (Fichman et al. 2011). Prior research shows that an insufficient HIS can potentially increase tensions, for

instance by disrupting routines or limiting the flexibility of healthcare actors (see e.g., Goh et al. 2011).

Given this danger, prior research has identified the difficulties involved in implementing HIS as “one size fits it all” (Oborn et al. 2011; Poon et al. 2004). Scholars suggest that the design and functionalities of HIS and evolved practices need to be aligned carefully (Ammenwerth et al. 2006; Goh et al. 2011), such that the HIS meets local requirements and the complexities of the wider socio-organizational context. Such adjustments require consideration of different perspectives and needs (Cresswell and Sheikh 2013; Heeks 2006). Consequently, several literature reviews have identified user involvement as critical success factor for the design and implementation of HIS (Cresswell and Sheikh 2013; Rahimi et al. 2008).

Involving users early by creating interdisciplinary teams is aimed at aligning various technical, social, and organizational factors of healthcare work, which are often not documented and vary locally (Cresswell and Sheikh 2013). Developing a shared understanding of these factors requires the integration of different perspectives, the resolution of discrepancies in understanding and the negotiation of issues of individual and collective understanding (Akkerman et al. 2007). Multiple stakeholders need to share and integrate their idiosyncratic knowledge related to technical, social and organizational factors to identify necessary adjustments to the HIS and the environment and, eventually, to avoid unintended consequences (Rahimi et al. 2008).

2.1 Shared Understanding

Shared understanding is commonly defined as “the overlap of understanding and concepts among group members” (Mulder et al. 2002, p. 36) and refers to the extent to which a basic understanding of a common subject matter exists (Tesch et al. 2009). The common subject matter in IS implementation is the adaptation and introduction of an IS that is well aligned with existing and emerging work practices (He et al. 2007; Hoffmann et al. 2013; Levesque et al. 2001; Tesch et al. 2009). As our research focuses on HIS implementation in hospitals, we define shared understanding as overlapping mental representations of knowledge and experience that allow people involved in HIS implementation to form joint explanations and expectations of the HIS and how it affects healthcare work.

It is assumed that an understanding of reality is primarily constructed in the mind of the individual by organizing and combining new experiences with existing experiences and knowledge (Vygotsky 1978). Thus, there are multiple constructions of reality and there is no objectively right understanding of a certain object of interest that matches reality, “but rather different conceptualizations that may ‘fit’ reality better or worse” (Bittner and Leimeister 2014, p. 116). That said, research on shared understanding clearly shows that combining and aligning IT professionals’ and stakeholders’ individual understandings is important for successful IS implementation projects (see e.g. Faraj and Sproull 2000; He et al. 2007; Hoffmann et al. 2013; Hsu et al. 2014; Levesque et al. 2001; Schmidt et al. 2014; Tesch et al. 2009).

Shared understanding does not imply that people involved in IS implementations simply accumulate individual conceptualizations of reality. Rather, they need to share their perspectives, negotiate meanings, and agree on a mental representation they want to follow

(Bittner and Leimeister 2014). Moreover, it is assumed that teams hold several mental representations, which are usually framed as task- and team-related models and cover knowledge about the task, the way the task is approached or the team itself (Bittner and Leimeister 2014; Cannon-Bowers et al. 1993). To date, however, IS research has barely worked out what kind of knowledge and experiences need to be shared to support effective HIS implementation (Bittner and Leimeister 2014).

Though prior research reveals that insufficient fit between the HIS and the socio-organizational context contributes to HIS implementation failure (Ammenwerth et al. 2006), the kind of knowledge about the activities affected by IS implementation that needs to be shared remains unclear. AT provides concepts to analyze collective IS-mediated activities and to approach this gap by exposing the interrelations of the constituents of work activities and illuminating the socio-organizational context. Hence, AT is positioned to help us identify what needs to be recognized, shared, and considered during HIS implementation, particularly concerning the role of the HIS within the affected activities.

2.2 Activity Theory

AT has emerged as an important theory for understanding change of IS-mediated work activity (Karanasios et al. 2015). AT relates the different conceptions of human activities and the material, mental, and social resources through which they are enacted (Blackler 1995; Engeström 2001). To frame these relations, AT introduces the ‘activity system’ as an analytical unit of how diverse actors work together (Engeström 2001).

The triangular activity system comprises the mutual aim of the activity (the *object*), the people directed towards the object (the *subject*), cognitive and material *instruments* used to realize the outcome, explicit and implicit *rules* that govern the work, the way tasks are distributed (*division of labor*) and the wider *community* of practitioners that revolve and evolve around the object (Engeström 1987; Engeström 1999; Kaptelinin 2005; Nicolini et al. 2012). Instruments, rules, and the division of labor empower actors with experience and skills collected in the past, relate the subjects to the community and determine the possibilities and boundaries of their actions (Kaptelinin 2005; Kuutti 1995; Nicolini et al. 2012; Vygotsky 1978).

The object as a key concept of AT refers to a physical or cognitive entity that is under construction, moving from a ‘problem space’ to a result or an outcome (Engeström 1999; Engeström 2001). As the motivation that drive the collective activity, the object takes shape and acquires its value by being transformed by the subject. Thus, the object is an enduring purpose of the activity and determines individual goals and actions through which, in turn, it may be achieved (Engeström 1999). In the HIS context, the object of healthcare delivery is the patient which nurses and physicians care for. Their actions and interactions are ultimately patient-focused. Amongst others, these actions are mediated by HIS and medical devices, regulatory requirements, a strict hierarchy, and professional autonomy (see Figure 1).

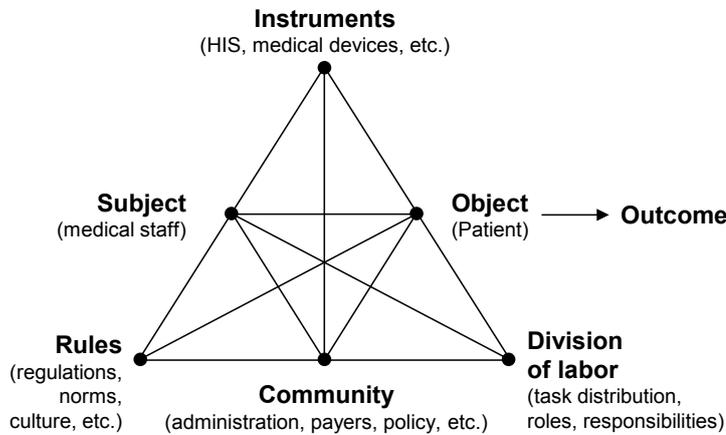


Figure 1: Activity System Diagram

Though object-relatedness is a key characteristic of human activity (Leont’ev 1978), it is not free of contradictions. People frequently perceive difficulties in constructing a connection between the goals of their individual actions and the motive of the collective activity (Leont’ev 1978). These problems derive from the multi-faceted and contradictory nature of human activities (Engeström 1999). AT views activity systems as an accumulation of multiple perspectives, traditions and interests, where the division of labor creates different positions of the participants and the instruments, rules, and conventions carry multiple layers and strands of history (Engeström and Punamäki 1999). For instance, different perspectives on the patient are likely to contradict within healthcare activities: some actors view patients as human beings in need of help, while others see them as sources of revenue. Likewise, HIS as one of multiple instruments employed in healthcare activities can be viewed as a resource to provide better healthcare or to generate higher revenues.

Such contradictions within activity systems cannot be observed directly, but rather they can only be identified through their manifestations (Engeström and Sannino 2011), such as tensions, disturbances, and breakdowns that destabilize activities and reveal inefficiencies (Allen et al. 2013; Engeström 1999). Engeström and Sannino (2011, p. 371) state that “contradictions do not speak for themselves, they become recognized when practitioners articulate and construct them in words and actions”. Contradictions are thus to a significant extent manifested and constructed in discursive action, utilized by actors to make sense of, deal with and resolve them (Engeström and Sannino 2011). As they act as a trigger to reconsider given activities and their constituents, contradictions act also as drivers of change.

2.3 Activity Theoretical Perspective on HIS Implementation

Building on the insights of AT, we conceptualize IS implementation as a process of reconfiguring activity systems, which is aimed at the resolution of contradictions or alleviation of resulting tensions, disturbances or breakdowns. However, there is a risk that modifying elements in activity systems can have unintended consequences, such as creating new or amplifying existing contradictions. For instance, implementing an HIS to improve the reimbursement process in a hospital may accentuate tensions from a contradiction between

monetary motives and altruistic codes of healthcare activities, which, in turn, may lead to resistance.

To avoid unintended consequences, existing contradictions within the activity system need to be identified and new ones anticipated. Thus, we assume that the implementation of HIS not only requires knowledge of individual actions and interactions with the HIS, but also of the joint activity the HIS mediates. IT professionals, users and stakeholders thus need to share their individual knowledge and perspectives on the system of instruments employed in collective activities and rather invisible aspects such as rules and the division of labor as well as the strands of history they carry.

An understanding that combines divergent conceptions of the historically evolved and contested activity systems is expected to enable IT professionals and users to identify existing and anticipate novel contradictions within these activity systems and to agree on the role of the HIS within. Such shared understanding would enable implementation teams to proactively adopt strategies or take measures to avoid unintended consequences such as purposeful adaptations to the HIS or other elements of the affected activity systems. Vice versa, we expect that significant obstructions of work activities indicate that the people involved in HIS design and implementation based their actions on insufficient shared understanding of the contested activity systems.

3 METHODS

We conducted two in-depth case studies and take an interpretative lens to identify the characteristics of healthcare activities about which a shared understanding is needed during HIS implementation. An interpretive lens acknowledges that people create their own subjective and inter-subjective meanings as they interact with the world (Orlikowski and Baroudi 1991; Walsham 1995). Case studies are capable of providing an ample description and of these perspectives that can then be analyzed (Yin 2009). Thus, interpretative case studies are well suited to exploring critical components of healthcare activities that need to be recognized, considered, and shared to ensure successful HIS implementation.

In line with Eisenhardt's (Eisenhardt 1989) recommendation for case study research, we framed our research question in the light of prior research. Moreover, we engaged in an iterative process of considering theoretical concepts from extant literature, developing assumptions about the aspects of shared understandings, comparing the patterns identified with our theoretical deliberations and enhancing our theoretical perspective (Walsham 1995). Here, the interplay between the literature and the empirical data of the first case study led to an initial version of the AT perspective on IS implementation. The second case study was then conducted to refine and corroborate the explanatory value of our theoretical insights (see also Figure 2).

3.1 Research Cases

The research site for both case studies was a large teaching hospital in Germany housing multiple clinics and specialist departments. The hospital employs almost 10,000 people and

provides healthcare services for about 400,000 patients annually. Between 2014 and 2016, we had the chance to observe two major HIS implementation projects: the implementation of a patient data management system (PDMS) for critical care units ('CareSys') and a PDMS for general wards ('PatientDoc'). Both implementation projects were employed to resolve contradictions within the healthcare activity system, particularly related to changed regulatory requirements and increased cost pressure.

PDMS guide and support clinical workflows by enabling healthcare professionals to collect and access patient-related data such as vital parameters and information about the course of disease (Fretschner et al. 2001). Besides tracking patient status, treatment-related data such as nursing tasks, orders, and medication plans can be managed within these activity systems. Moreover, PDMS also provide support for clinical decision making by aggregating, analyzing and visualizing available data and facilitate accounting processes.

In both cases, novel HIS were implemented to resolve tensions between the abilities of legacy instruments and evolving characteristics of healthcare activities such as changing regulatory requirements and the need to increase efficiency of patient care.

The implementation strategies adopted in both projects were quite similar. Once a vendor was selected, the general requirements for the PDMS were developed. Afterwards, the PDMS were rolled out ward by ward. The implementation at the wards followed a standard implementation procedure. First, a specification document that reflects ward-specific requirements was created in a joint effort between the project team and key users. The viable requirements were then implemented. Users were trained before the rollout of the PDMS on the wards. During the rollout phase, members of the project team were on the wards to help the staff implement the PDMS within their day-to-day work and to address emerging issues.

The rollout strategies included key success factors noted in the literature: selection of adequate technology, senior leadership, and continuous consultation of key-users during all project phases (Cresswell and Sheikh 2013; Cresswell et al. 2013). Thus, we expected that the cases will offer the opportunity to identify peculiarities of healthcare activities that are not easily recognized by best-practice measures, but are critical for avoiding unintended consequences. Below we briefly present the peculiarities of the two cases.

CareSys Implementation Case

It was decided to replace the legacy PDMS (hitherto CareSysOld). CareSysOld was first implemented approx. 20 years ago and used in all 15 critical care units of the hospital. During the years, IT and medical stakeholders made great effort to align CareSysOld with existing and emergent characteristics of the activities at the critical care units. However, the PDMS no longer complied with Germany's Medical Device Act (implementing EU Directive 93/42/EEC, 2007/47/EC, Article 1, 2a). Further, physicians increasingly asked for advanced medical decision support functions, which are not covered by CareSysOld. However, implementing CareSys was primarily aimed at ensuring compliance with new regulatory requirements.

The high-level requirements that guided the selection of a successor PDMS were primarily developed in alignment with functionalities inscribed in CareSysOld. In developing these requirements, the involved IT professionals were further able to draw on their experiences and practical knowledge as former nurses and the input of selected physicians. Potentially

suitable software packages were then evaluated by clinical and administrative users as well as IT professionals.

PatientDoc Implementation Case

Also in 2011, the hospital started an initiative to gradually implement PatientDoc as an additional HIS for care documentation at nursing-intensive wards such as internal medicine, gynecology, and psychiatrics. Here, too, PatientDoc was implemented to improve compliance with legal requirements, increase efficiency of day-to-day clinical activities and optimize reimbursement.

The vendor of PatientDoc provided several basic templates for various clinic specializations that reflect best practices from other hospitals. In the early phase of the project, the project team involved various users, whose task was to learn how the templates need to be aligned with local standard processes. The resulting customized templates include approx. 80% of the functionalities needed in all clinics. The remaining 20% were identified as ward-specific and were added as customization prior to the rollout.

3.2 Data Collection

To ensure the reliability and credibility of the data collected, we applied different methods and involved multiple informants (Miles and Huberman 1994; Walsham 1995; Walsham 2006). Specifically, we interviewed key users and project team members and talked to and observed nurses and physicians before, during, and after the rollout of the PDMS. Moreover, we reviewed project-related documents such as requirements specifications and training material. Data on the implementation of CareSys was collected in two intensive care units, while data on the implementation of PatientDoc was collected on a single ward of the psychiatric clinic. The teams of both projects had significant experience as both PDMS had already been rolled out at other wards within the hospital. Moreover, the templates of the PDMS were already refined so that they sufficiently cover most standard requirements during these prior rollouts.

The formal interviews were set up as semi-structured conversations supported by an interview guideline (Yin 2009). The guideline concerning the PatientDoc implementation primarily focused on the interviewees' knowledge and experiences on the affected activities and the role of the HIS within. The guideline used for the CareSys project also contained open questions on the nature and quality of interactions between the various occupational groups involved (e.g., IT professionals, physicians, and nurses). Table 1 summarizes the interviews conducted in each case study.

Table 1: Formal Interviews

Interviewee	Interviews (length)	Documentation
<i>CareSys</i>		
CS-PT01 (Project manager, IT consultant, external)	1 (70 min)	Notes/report from memory
CS-PT02 (Project team, IT staff, nursing background)	1 (120 min)	Notes/report from memory
CS-PT03 (Project team, IT staff, nursing background)	2 (105 min)	Verbatim report
CS-SH01 (Stakeholder, IT staff, medical background)	2 (70 min)	Notes/report from memory
CS-NU01 (Nursing manager)	3 (120 min)	Verbatim report
CS-NU02 (Nurse on the ward)	1 (30 min)	Verbatim report
CS-NU03 (Nurse at the ward)	1 (60 min)	Verbatim report
CS-PH01 (Assistant medical director)	1 (40 min)	Verbatim report
CS-PH02 (Assistant medical director)	1 (65 min)	Verbatim report
CS-PH03 (Physician at the ward)	1 (40 min)	Verbatim report
<i>PatientDoc</i>		
PD-PT01 (Project manager, IT professional)	1 (45 min.)	Notes/report from memory
PD-PT02 (Project team, IT professional)	3 (90 min.)	Notes/report from memory
PD-PT03 (Project team, nursing background)	1 (40 min.)	Verbatim report
PD-PT04 (Project team, nursing background)	1 (50 min.)	Notes/report from memory
PD-PT05 (Project team, nursing background)	1 (50 min.)	Notes/report from memory
PD-NU01 (Nurse at the ward)	3 (110 min.)	Verbatim report
PD-NU02 (Nurse at the ward)	3 (70 min.)	Verbatim report, notes
PD-M01 (Ward Mgr., line manager of nurses)	3 (100 min.)	Verbatim report, notes

The purpose of holding interviews was to understand knowledge-integration processes between the project team and the users, and particularly to expose which knowledge, experiences, and perspectives they shared. The interviews were recorded and transcribed whenever possible. Some of the interviewees did not want to be recorded, so comprehensive notes were taken and a report from memory based on these notes was prepared immediately after the interviews.

To identify emerging issues and to collect data on the tensions within the activity system that may cause these issues, we also observed how users interact with the HIS either during or shortly after the rollout. In addition, we conducted numerous informal conversations with nurses, physicians, and the members of the project team to gain understanding of the issues we have observed and on underlying tensions. These casual conversations and observations were immediately recorded in the case diary.

3.3 Data Analysis

In analyzing the data, we followed the guidelines of Miles and Huberman (1994) and the principles of interpretive research (Walsham 1995). To ensure inter-rater reliability, one researcher coded the data, and a different researcher cross-checked the coding. Different views on the coding were discussed and resolved within the team. Once agreement on the coding was reached, emerging patterns were compared, analyzed, interpreted and discussed in the team (Miles and Huberman 1994). Whenever the interpretations differed, the research team went back to the data, theory, and/or the field and discussed the findings until an interpretation was developed that was plausible for all authors (Walsham 1995).

Following this strategy, we first analyzed the CareSys data. Based on the theoretical and empirical insights gained, we then planned and conducted data collection and analysis of the second case study. Both occurred in a mode of continuous interplay, such that we were always open and willing to modify our initial assumptions (Walsham 2006). Data collection lasted until all inconsistencies and gaps were resolved. Figure 2 depicts the iterative process of data collection and analysis.

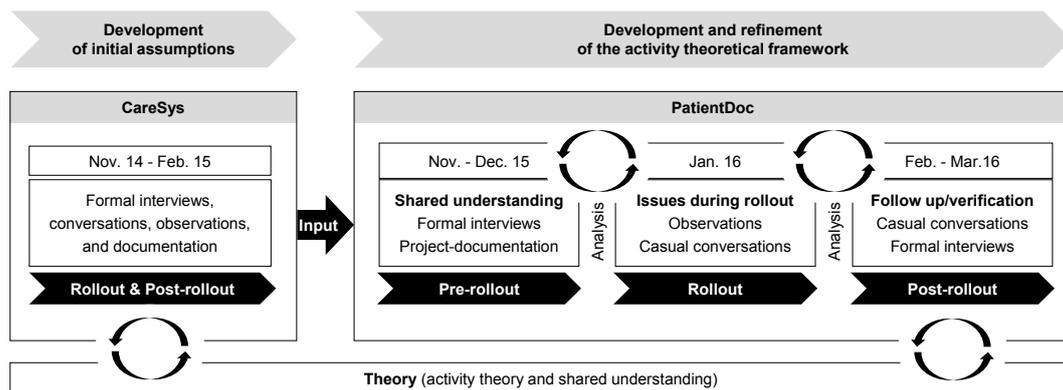


Figure 2: Iterative process of data collection and analysis

The iterative data analysis process was as follows. First, data on the individual conceptions of the work activity was coded following an open coding approach (Miles and Huberman 1994). Second, the resulting codes were analyzed and subordinated categories were formed. These categories were then assigned to an activity system component (e.g., subject or rule) or a relationship between multiple components (e.g., relation between actors and implicit rules). Third, we compared the findings in each category to identify similarities, connections, and patterns between the individual conceptions. Fourth, we analyzed the issues that emerged during the rollout and potential tensions between the PDMS and the healthcare activities. To do so, we coded data from the rollout phase in search of characteristics of the activity system that had not previously been shared as well as indications of underlying tensions. We again created categorical codes, compared the resulting codes with the activity system components and assigned them to one of the activity system codes. Finally, we analyzed the coded data and created a conceptual matrix (Miles and Huberman 1994). For each problem that emerged, the matrix encompassed the characteristics of the activity system that were covered by the shared understanding before the rollout as well as our AT analysis of tensions within

the activity system. This matrix allowed us to generate an overview of relevant data and to analyze how the emerging problems relate to perspectives, knowledge, and experience that were evidently not shared during adaptation and implementation of the PDMS. This iterative process resulted in our activity theoretical framework on shared understanding in HIS implementation. Finally, we returned to the data from our first case study and tested if this framework offers a conclusive interpretation of the outcomes of the CareSys implementation.

4 FINDINGS

The rollout team, which paid attention to the key success factors as noted in the literature (Cresswell and Sheikh 2013; Cresswell et al. 2013), was able to roll out the PDMS at the wards observed in this study. The software basically enables nurses to document relevant data and to comply with regulatory requirements. Moreover, it offers data in better quality to management and clinicians.

However, in both implementation projects significant issues were observed during and after rollout. These led to unintended consequences such as inefficiencies and resistance among key-users. Below, we briefly present three issues that reflect the most apparent unanticipated and unintended consequences observed. We illustrate the tensions and underlying contradictions and analyze knowledge and experiences concerning the collective activities that were not shared among the participants of the implementation projects.

4.1 Divergent Motives

The first issue concerns how the instruments reflect the different perspectives the occupational groups have on the object of their collective activity. Moreover, the issue also affects how the associated motives govern the interactions between stakeholders (e.g., in cases of emergency).

In the course of implementing CareSys, physicians called for documenting more data and more accurate data. CareSys was adapted accordingly and many different fields were set to collect data needed to enable physicians to make better treatment decisions. However, the project team was not aware that this aim was not easily aligned with nurses' priorities. Instead of documenting more data, the nurses wanted to invest their limited time to optimally care for patients. Thus, the project team did not take measures to balance the divergent requirements when adapting CareSys. Rather, they enabled documentation of myriad different parameters within the software. As a consequence, the nurses were confronted with what they perceived as overloaded and confusing input forms. Due to limited usability and the need to record additional parameters, nurses' documentation effort increased significantly after the implementation of CareSys. Ultimately, the conflicting priorities and the way CareSys emphasized the interests of physicians caused substantial opposition among nurses towards the new HIS and significant adjustments to CareSys after the roll out.

A similar dynamic was observed in the PatientDoc implementation. In the years prior to the implementation of PatientDoc, the nurses at the addictive disorders ward created and gradually refined 'monitoring sheets' for every patient. These letter-sized sheets hung at the

black-board and helped nurses to keep track of patients (e.g., in case of emergency and during shift handovers) and provide optimal care to patients. Data such as vital parameters, adapted dosages or important events were recorded on these sheets before the formal documentation was updated.

During requirements elicitation, it was decided to replace the monitoring sheets with PatientDoc reports. Recording and analyzing data directly in PatientDoc should reduce errors and provide physicians instant access to care documentation. While PatientDoc was able to satisfy the information needs of physicians, the reports offered by the software were not able to replace the monitoring sheets sufficiently because the reports had to be activated manually, were only accessible via the small monitors on the wards, and did not give nurses a quick overview of the patients and their care needs. PD-NU02 stated, for instance, that *“the monitoring sheets made it much easier to get an overview of patients [...] which is quite important on a closed psychiatric ward.”* PatientDoc’s reports did not serve as a to-do list and reminder the way the sheets had done. This made shift hand-over considerably more cumbersome and nurses’ willingness to utilize PatientDoc decreased substantially.

Although the tensions between the adapted set of instruments and the nurses began to surface early, the project team, ward management, and physicians were not able to understand why nurses requested to keep the monitoring sheets. Particularly physicians, who require timely and accurate data, advocated to use the PatientDoc reports. This indicates that the project team did not thoroughly consider the role of the monitoring sheets as an important mediator between the actions and interactions of the nurses. Rather, they were not aware that forcing the nurses to use PatientDoc exclusively limits their time and ability to care for patients (e.g., adapting medication, keeping track of patients), which they consider the true focus of their activity (*“we spend too much time at the computer and have less time for the patients”*, PD-NU01)

4.2 Rule-related Contradictions

The second issue involves interrelations between the PDMS and implicit and explicit rules such as regulatory requirements and culture at the wards.

During the rollout of CareSys it became obvious that physicians were more easily able to implement the novel documentation instrument within their work than nurses. Our analysis reveals that pronounced diligence is an essential value of the organizational culture at the ICUs. Particularly the nurses are accustomed to following orders and fulfilling their tasks in a conscientious and structured way. This may have a legal component, because physicians are permitted to perform specific actions that non-physicians are forbidden to perform. Our analysis indicates that the organizational culture encouraged nurses not to question the type and quantity of information requested by CareSys. Rather, they wanted to fill all the data CareSys requested, even though not all fields were relevant for all patients at all wards. This implicit rule resulted in an unintended, but significant increase in nurses’ workload.

However, the project participants only noticed this culture-related tension when the nurses complained about the difficulty they had filling in the data fields (e.g., confusion and additional effort). Thus, the issues could only be resolved by implementing rules which define the mandatory data field for the different wards.

The PatientDoc implementation project also revealed issues concerning the relation between the software and the rules at the wards. The issue in this case study pertains to the traditional way of medication management at the addictive disorders ward. By law, nurses are only allowed to administer drugs as prescribed by a physician, but physicians are not always physically present at the addictive disorders ward. In emergency situations, nurses must adapt the dosage intervals themselves and then get authorization via phone (e.g., in case of acute delirium, restlessness or shivering). This temporary shift in the division of labor and authorization procedure has become an accepted norm at the wards.

Physicians, nurses, and IT professionals were aware of the significance of medication management and intensively discussed the need for adapting dosing intervals on short notice. However, their shared understanding did not enable them to anticipate that PatientDoc considerably restricts the flexibility as given by the paper-based instrument, particularly in cases of emergency. The tensions between the necessity of adapting task distribution in cases of emergency and formal requirements were not uncovered until the rollout. Until then, the nurses were not aware how the HIS would affect this variation of the scripted division of labor concerning medication handling.

During the rollout of PatientDoc, however, the nurses recognized that the time and date of adapting medication dosages and administering adapted medication is recorded. Thus, the PatientDoc does not allow them to adapt the administration of medications on short notice or to enter physicians' authorization after administering adapted medication. Awareness of these issues negatively impacted nurses' attitude towards PatientDoc. This even caused some of them to resist using PatientDoc until it was clarified how medication management in cases of emergency is governed and how the conflicts would be solved.

4.3 Disruption of Traditional Division of Labor

The third issue reflects how gradual changes to the object of healthcare affected the division of labor. Themes in both cases show that if the novel instrument is not able to efficiently govern distribution of tasks, novel tensions are likely to arise or existing tensions are likely to be amplified.

Analysis of the CareSys implementation project revealed that CareSysOld considered different information needs at the wards and accounted for divergent needs of the occupational groups as related to their perspective on the patients. Hereby, it was able to effectively govern assignment of tasks as for example during the case review sessions.

In order to ease interoperability, testability, and maintainability as required by the Medical Device Act and to contribute to standardization efforts promoted by regulation and management, CareSys only allowed minimal ward-specific adjustments of standard screens. Thus, CareSys was not able to account for ward-specific procedures and related information needs of physicians and nurses. As CareSys tries to cover informational requirements of different disciplines on few screens, the screens are rather crammed and not that as clear as those of CareSysOld (see also issue one). However, evolved workflows concerned with information exchange and task-assignment were highly dependent on quick and clear access to relevant information. For instance, at the ward observed, the chief physician used to review cases by calling them up patient by patient. For each patient, the responsible physician and

the chief nurse quickly had an overview of patient data in CareSysOld and gave recommendations. These were discussed and then tasks were assigned to the nurses.

As the standardized CareSys screens did not allow physicians and nurses to quickly review relevant information and to fulfil their traditional roles during case reviews, efficiency of these workflows was significantly lowered. As with other tensions observed, it was only during the rollout that the project participants determined that CareSys fulfills the requirements of the Medical Device Act but is not flexible enough to adapt to traditional approaches at the wards, particularly to the way tasks are distributed.

Another example of PDMS interfering with the traditional division of labor was only observed during the rollout of PatientDoc. During the last years, cost pressure and workload had increased significantly at the wards, which underscored the need to increase efficiency. In response, the way tasks are distributed was continuously adapted. For example, volunteers and trainees are increasingly asked to measure and document vital parameters. Legally, this must be supervised and authorized by a certified nurse, who also signs the documentation. In practice, however, nurses have limited time to accompany the volunteers and trainees.

In compliance with IT policy, volunteers do not possess user accounts authorized to perform documentation in PatientDoc. Thus, after the rollout of the HIS, documentation of vital parameters was limited to nurses and trainees. This obstructed the evolved mode of task distribution and increased nurses' documentation effort considerably. Since they had to spend more time recording vital parameters on their own or accompanying volunteers and trainees, they had less time to care for patients. Moreover, some of the nurses were reluctant to key in data they have not collected (*"I will not key in data that I have not measured personally"*, PD-NU03).

Data collected prior to the rollout reveals that nurses and IT professionals did not have shared knowledge about the nature, history, and significance of the task distribution at the wards and how PatientDoc would enforce responsibilities. During requirements elicitation, IT professionals and nurses did not consider how PatientDoc could amplify tensions between legal requirements and the division of labor. Thus, neither IT professionals anticipated that the characteristics of the IT tool would interfere with established ways of distributing tasks, nor ward management was able to clarify roles and responsibilities and thus take measures to mitigate or resolve these tensions.

4.4 Summary of Findings

The HIS implementation projects analyzed intended to resolve tensions by replacing existing instruments that did not comply with regulatory requirements and limited the efficiency of healthcare delivery. Paying attention to key success factors identified in the literature, the project teams were able to adapt the PDMS to cover most requirements, particularly those that concern the interactions of individuals with the software. However, as with similar HIS implementation initiatives reported in prior literature (Cresswell and Sheikh 2013), replacing the legacy instruments had unintended consequences. These were not anticipated, although the people involved could build upon experiences from several rollouts prior to the ones analyzed here as well as best-practices and templates.

As shown in the analysis of the cases, most unanticipated issues observed can be traced back to insufficient shared understanding of the activities affected by the HIS, i.e. the socio-technical environment the HIS is embedded in. On the one hand, the participants in the implementation projects managed to identify the key stakeholders, their individual expectations, obvious properties of the legacy instruments related to individual tasks and important regulatory needs. However, they failed to share and integrate their knowledge and experiences about contradictions within the affected activity systems, particularly concerning the object and the wider socio-organizational context involving the rules and the division of labor. Consequently, they had problems anticipating how the novel instrument would affect these contradictions and thus taking steps to prevent or mitigate novel tensions. Table 2 provides a summary of these findings.

Table 2: *Contents and gaps of shared understanding*

Characteristics covered by shared understanding	Characteristics <u>not</u> covered by shared understanding
Primary users of the PDMS and occupational groups involved in the activities that are affected by the PDMS – the stakeholders of IT implementation	Contradictory perspectives on the objective of healthcare activities (e.g., caring for patients vs. documentation quality and costs) that evolved over time and result in different interpretations of the role of the PDMS within the collective activity – the relation between the PDMS and contradictions associated with the object
Expected individual performance gains (e.g., documentation, reimbursement) – the requirements on the PDMS based on individual goals	
Obvious properties of the legacy instruments (e.g., types of data-fields, forms, reports) related to individual tasks – the requirements on the PDMS based on material properties of the legacy instrument that enables individuals to perform their task	Enhancements of the documentation instruments that enable them to support the roles and interactions of health care personnel (e.g., by governing case reviews) – the relation between the PDMS and the division of labor that have developed over time.
New regulatory requirements (e.g., transparency, authentication, and medication handling) – requirements on the PDMS related to the explicit regulatory limitations of the activity	Interpretation and implementation of explicit and implicit rules that evolve over time – the relation between the PDMS and contradictions associated with the rules that characterize the activity

5 DISCUSSION

Prior to discussing our findings and proposing a framework that captures critical characteristics of healthcare activities and provides a coherent explanation for the emergence of unintended consequences, we acknowledge the limitations of our study. First, the empirical data analyzed in this research stem from only two case studies at a single site. Thus, the activity theoretical perspective on shared understanding still needs to demonstrate its explanatory power in other settings (Lee and Baskerville 2003). Second, data about early

phases of both projects could only be collected retrospectively. Third, the timeframe for data collection was restricted. Acknowledging that activity systems are shaped over space and time, the rise of additional unintended consequences after data collection cannot be ruled out. Fourth, the number of interviews conducted is limited, some of the interviewees did not want to be recorded and only one researcher monitored the rollout. Further research employing additional multiple and longitudinal case studies in other settings or quantitative studies may increase the confidence in the mechanisms discussed below.

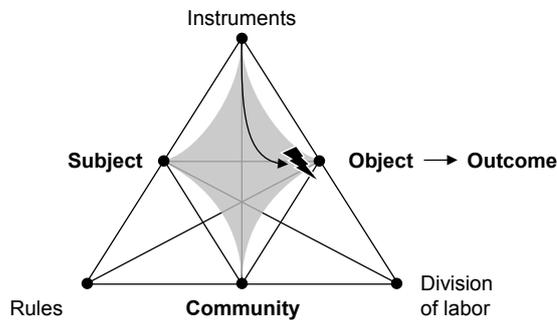
5.1 Framework of Critical Contents of Shared Understanding

The unintended consequences observed in this study indicate that users, managers, and IT professionals had difficulties sharing often tacit knowledge and experiences related to three socio-technological characteristics of the collective activities. As a result, they struggled to anticipate how these nexuses relate to the new HIS, particularly how existing contradictions within the activity systems are mitigated or amplified by HIS implementation. Figure 3 locates these nexuses in triangular activity system diagrams.

The first socio-technical nexus reflects that healthcare activities are inherently characterized by contrasting objectives (object-related nexus). Our analysis reveals that the legacy tools and the novel HIS emphasize different perspectives on the object of the collective activity. However, the way the HIS account for these perspectives and how this may mitigate or amplify existing contradictions was hardly considered (e.g., maintaining monitoring sheets vs. entering data directly in the HIS and using the reports). We found that exposing the contested nature of the activities and bearing in mind how the instruments account for divergent motives and thus how they impact the relationship between professional groups is critical. Creating shared understanding of this aspect is likely to have enabled actors to anticipate and avoid the issues.

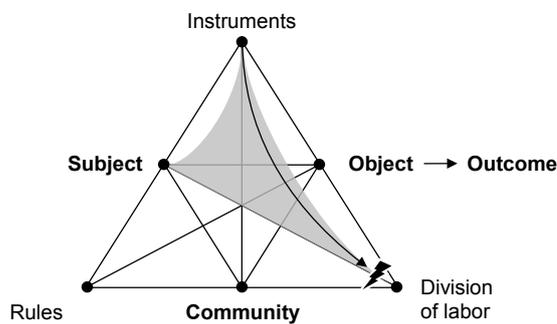
Second, patient care involves an inherent tension between the need for stability and sensitivity for variation (Fichman et al. 2011). To cope with this tension, among others, the division of labor that evolved over time needs to support orderly routines and account for local or temporary variations. As mediating artefacts, instruments need to account for these evolved and diverse modes of task distribution (division of labor-related nexus). During HIS implementation projects, actors must thus ensure that the newly implemented instruments can govern routines and variations like the legacy instruments did. Otherwise, adaptations to the division of labor are necessary (e.g., task distribution between nurses, trainees, and volunteers).

Third, although healthcare is highly influenced by regulation and traditional hierarchies (Fichman et al. 2011), exceptions must sometimes be made, especially in case of emergency. Since HIS are often designed to comply with standards and formal rules, they have the potential to intensify contradictions between formal rules and implicit conventions (rules-related nexus). Hence, people engaged in HIS implementation need to recognize, share, and consider explicit and implicit rules that govern actions and interactions between the subject and the community. Based on shared understanding of these nexuses, actors should be able to clarify how the HIS influences these rules and to plan measures that prevent the increase of existing tensions or the emergence of new ones.



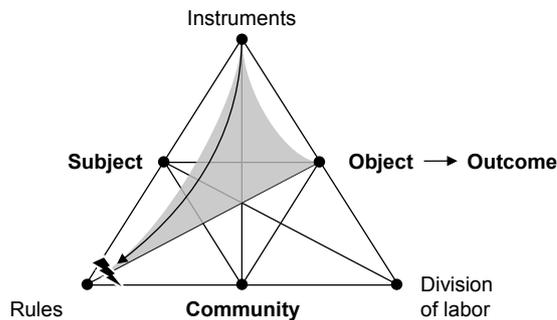
The **object-related nexus** refers to instrument-mediated relationships between the subject, the community and the object.

A shared understanding is needed about the objectives shaped by medical and managerial considerations, among others. Moreover, actors involved in IS implementation projects need to clarify how the novel IS relates to (different) perspectives on the object.



The **division of labor-related nexus** refers to instrument-mediated relationships between the division of labor and the object.

Actors involved in IS implementation projects need to clarify how the novel IS relates to evolved and often diverse modes of task distribution that govern actions towards the object. Particularly, shared understanding needs to enable actors to anticipate how the IS ensures stability and provides sufficient variability.



The **rules-related nexus** refers to instrument-mediated relationships between the rules and the object.

Actors involved in IS implementation projects need to clarify how the novel IS accounts for interpretations and/or implementation of (conflicting) rules that govern actions and interactions towards the object and developed over time. Amongst others, actors should consider if the implementation of additional rules that govern HIS usage reduces tensions.

Figure 3: *Socio-technical aspects of healthcare activities about which a shared understanding is needed*

5.2 Implications for Theory

The theoretical and empirical findings of this study provide further evidence that it is helpful for both academia and practice to understand IT as an inherent component of human activity. The conception of IT as an interlinked and mediating artefact within a complex systems of other instruments, rules/norms and a division of labour is in line with the conception of IT as an artefact that is holistically interwoven with other object-related entities, or what Heidegger (1962) calls objects with an “*in-order-to*” (Riemer and Johnston 2013, p. 276).

However, creating a shared understanding of the form and functioning that enable a novel instrument to efficiently replace a legacy tool without causing new contradictions or amplifying existing ones is apparently difficult. This is certainly also due to the fact that, during everyday use, IT and other instruments are not easily encountered as objects with

properties/features, but as practical means that receive less attention than the ends they are used to achieve (Riemer and Johnston 2013). Sometimes, mediating instruments seem to be only present as an object of attention in breakdown situations, such as when contradictions and tensions manifest themselves. Then some level of attention is required to resolve the problem. Thus, some shortcomings of the PDMS were only visible once it was implemented in daily practice.

To avoid problems after enrolling new instruments, participants involved in HIS implementation need to expose their interpretation of both the legacy instrument and its successor as well as their places in the systems of other instruments, rules/norms and a division of labour early on. In line with Heidegger's (1962) idea that equipment bears for what it is (as an *in-order-to*) on other objects with which it is used, this study indicates that HIS as mediating instruments do not only need to have "the kinds of material properties that enable it to do what it is supposed to do", they also need to have their "place in the holism of other equipment, shared practices, identities and social orthodoxies" (Riemer and Johnston 2013, pp. 279-280).

Understanding the place of the legacy instrument within the activity systems, anticipating the place of the novel instrument and designing and implementing it accordingly requires social sense making. Involved actors need to share and integrate their perspectives on the socio-technical system in which the HIS is intended to operate and agree on how the HIS will become a legitimate and supportive part of the activity system without creating or amplify contradictions. In this regard, prior research already emphasizes the significance of shared understanding (see e.g. Faraj and Sproull 2000; He et al. 2007; Hoffmann et al. 2013; Hsu et al. 2014; Tesch et al. 2009). However, the literature has not yet precisely defined the kind of knowledge and experiences that need to be reflected (Wildman et al. 2014). In this study, three critical socio-technical characteristics of healthcare activities are revealed. These relate to the place and role the HIS takes within the systems, while they are themselves influenced by HIS. By showing that divergent knowledge and experiences about these characteristics of collective activities should be shared and integrated when integrating a novel HIS, we extend prior research on shared understanding in HIS implementation.

By contributing a theoretically grounded classification of these characteristics, we also respond to the call for research on the socio-technical complexities HIS is facing (Bittner and Leimeister 2014). We show that being unaware of these complexities increases the change of the emergence of unintended consequences such as inefficiencies and resistance among key-users. The application of AT and the framework developed here may motivate research to further improve our understanding of the complexities of healthcare activities and collective sense making of the socio-technical context during IS implementation.

The theoretical ideas developed in this paper stem from analyses of HIS implementation case studies, but the framework is potentially applicable to IS implementation in similarly complex settings with similar socio-organizational dynamics, such as professional organizations (Diefenbach and Sillince 2011). As is the case in hospitals, professional organizations are characterized by activities dominated by complementary professions organized into distinct formal and informal hierarchies. Future research may demonstrate how our framework can be adapted to achieve a shared understanding of the role of IS and, thus, successful IS implementation in governmental agencies, institutions of higher education, or consulting and accounting firms.

5.3 Implications for Practice

The framework developed in this research draws attention to the wider context of individual action that shapes healthcare activities, particularly to the complex mediating relationships between instruments, rules, and the division of labor. Applied during implementation projects, it may facilitate the creation of shared understanding of the role of the HIS within healthcare activities. Ultimately, it may enable project teams to avoid unintended consequences.

Though awareness of the critical characteristics will help, practitioners need to bear in mind that an important prerequisite to learn about an activity is to participate in that activity (Greig et al. 2012). Thus, creating shared understanding may require IT professionals to occasionally participate in activities that are or may be affected by the HIS. This will most-likely enable them to better understand the nexuses identified here, to anticipate emerging issues and to develop corrective actions.

In line with this recommendation, the framework may also support the process identification and discovery phase of the business process management (BPM) lifecycle (Recker and Mendling 2015). Identification of local and temporal variations to the scripted course of action and sufficient understanding of the role of the instruments employed is not only a prerequisite for HIS implementation but also for redesigning business processes. Moreover, documenting processes and their variations may decrease dependency on shared understanding, at least in relative stable environments.

Practitioners may also employ cooperative strategies such as prototyping, where users and IT professionals are mutually involved (Mogensen 1992). Prototyping may raise issues and shifts questions from subject-object interactions towards the rather invisible IS-mediated characteristics of collective activities. Moreover, best-practices and approaches like BPM and the “MindMerger” (Bittner and Leimeister 2014) could benefit from methods that put an emphasis on the collective nature of human activity such as “expansive visibilization” does (Engeström 1999).

6 CONCLUSION

We know that effective design and implementation of IS is contingent on shared understanding (see e.g. Faraj and Sproull 2000; He et al. 2007; Hoffmann et al. 2013; Hsu et al. 2014; Tesch et al. 2009). However, our understanding about the kinds of task-related knowledge and perspectives that need to be shared is limited. Our research contributes to closing this gap by providing a theoretically grounded framework that captures crucial characteristics of healthcare activities that should be recognized, shared, and considered during HIS implementation projects.

Moreover, we contribute to prior research by increasing our understanding of the socio-organizational nexuses HIS must fit with (Ammenwerth et al. 2006). We reveal that the people involved in HIS implementation need to create shared understanding about socio-organizational characteristics that are not necessarily exposed using best-practice approaches. Following AT, actors involved in implementation projects need to recognize that

IS is in a complex mediating relationship with other elements of activity systems that developed over time (Engeström and Punamäki 1999). To resolve contradictions within these activity systems without provoking new ones, the multiple perspectives and traditions that are carried by its actors, its artefacts, rules, and conventions need to be recognized, shared and aligned.

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Paper IX

Taking up Three Challenges to Business-IT Alignment Research by the Use of Activity Theory

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Appendix

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Publications

PUBLICATIONS

Scientific Journals (Peer Reviewed)

Gewald, H., Wang, X., Weeger, A., Raisinghani, M. R., Grant, G., Sanchez, O., and Pittayachawan, S. 2017. "Millennials' Attitude towards Information Technology in the Workplace – A Generation of Cherry-Pickers?," *Communications of the ACM*. Forthcoming.

Weeger, A. and Haase, U. 2016. "Taking up three Challenges to Business-IT Alignment Research by the Use of Activity Theory," *International Journal of IT/Business Alignment and Governance* 7 (2), pp. 1-21.

Weeger, A. and Gewalt, H. 2015. "Acceptance and Use of Electronic Medical Records: An Exploratory Study of Hospital Physicians' Salient Beliefs about HIT Systems," *Health Systems* 4 (1), pp. 64-81.

Weeger, A., Wang, X. and Gewalt, H. 2015. "IT Consumerization: BYOD-Program Acceptance and its Impact on Employer Attractiveness," *Journal of Computer Information Systems* 56 (1), pp. 1-10.

Wiedemann, A., Weeger, A. and Gewalt, H. 2015. "Organizational Structure vs. Capabilities: Examining Critical Success Factors for Managing IT Service Delivery," *International Journal of IT/Business Alignment and Governance* 6 (1), pp. 49-69.

Conference Proceedings (Peer Reviewed)

Weeger, A. 2017. "How Do Project-related Artefacts Qualify for Bridging Boundaries in IS Implementation Projects – An Activity Theoretical Perspective," *Proceedings of the Hawaii International Conference on System Sciences, Waikoloa*.

Wiedemann, A., Gewalt, H., and Weeger, A. 2017. "How IT Management Profile and IT Business Value Correlate – Exploring Cross-Domain Alignment," *Proceedings of the Hawaii International Conference on System Sciences, Waikoloa*.

Weeger, A., and Ott-Schwenk, A. 2017. "What Teams Need to Be Clear about - an Activity Theoretical Perspective on Shared Understanding in Health IS Implementation," *Internationale Tagung Wirtschaftsinformatik, St. Gallen* *Best Paper Nominee*

Wiedemann, A., and Weeger, A. 2017. "Developing Intellectual Capital within Agile IT Teams: A Literature Review," *Proceedings of the European Conference on Information Systems, Guimarães*.

Schulz, T., Rockmann, R., and Weeger, A. 2016. "Service Composition in Networks – Towards a Typology of Intermediaries," *Proceedings of the Americas Conference on Information Systems, San Diego*.

Weeger, A., and Haase, U. 2016. "How Contradictions Facilitate Evolutionary Transformation: An Exploration into the Dynamics of Business-IT Alignment from the

Perspective of Activity Theory,” Proceedings of the European Conference on Information Systems, Istanbul.

Weeger, A., and Haase, M. 2016. “How Social Capital Between Medical and IT Professionals Shapes the Outcomes of Health Information System Implementation Endeavours,” Proceedings of the European Conference on Information Systems, Istanbul.

Weber, M., Weeger, A., Gewalt, C., and Haase, U. 2016. “The Effect of 'Device' in Task-Technology Fit: A Study of German Hospitals,” Proceedings of the Hawaii International Conference on System Sciences, Koloa.

Wiedemann, A., and Weeger, A. 2016. „How to Design an IT Department? A Review and Synthesis of Key Characteristics.” Proceedings of the Americas Conference on Information Systems, San Diego.

Rockmann, R., Weeger, A., and Gewalt, H. 2015. “Elderly People in eHealth: Investigating Internet Self-Efficacy and the Role of Occupational Internet Usage,” Proceedings of the Americas Conference on Information Systems, Puerto Rico.

Rockmann, R., Weeger, A., and Gewalt, H. 2015. “IT Capabilities and Organizational Utilization of Public Cloud Computing,” Proceedings of the European Conference on Information Systems, Münster.

Weber, M., Weeger, A., and Gewalt, H. 2015. “Disruptions of the Tripartite Structure of System Usage: Exploring Factors Influencing the Effective Usage of Information Systems in German Hospitals,” Proceedings of the European Conference on Information Systems, Münster. *Best Paper Nominee*

Weeger, A., Ohmayer, L., and Gewalt, H. 2015. “Operational Alignment in Hospitals – The Role of Social Capital between IT and Medical Departments,” Proceedings of the European Conference on Information Systems, Münster.

Weeger, A., Wang, X., Gewalt, H., Sanchez, O., Raisinghani, M. R., Grant, G., and Pittayachawan, S. 2015. “Determinants of Intention to Participate in Corporate BYOD-Programs – The Case of Digital Natives,” Proceedings of the Annual Meeting of the Academy of Management, Vancouver.

Wiedemann, A., Weeger, A., and Gewalt, H. 2015. “Organizational Structure vs. Capabilities: Examining Critical Success Factors for Managing IT Service Delivery,” Proceedings of the Hawaii International Conference on System Sciences, Koloa.

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Rockmann, R., Weeger, A., and Gewalt, H. 2014. “Identifying Organizational Capabilities for the Enterprise-Wide Usage of Cloud Computing,” Proceedings of the Pacific Asia Conference on Information Systems, Chengdu.

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Weeger, A., and Gewald, H. 2013. "Examining Social and Cognitive Aspects Determining Physician's Adoption of Electronic Medical Records," Proceedings of the European Conference on Information Systems, Utrecht.

Weeger, A., Gewald, H. and Vriesman, L. 2011. "Do Risk Perceptions Influence Physician's Resistance to Use Electronic Medical Records? An Exploratory Research in German Hospitals," Proceedings of the Americas Conference on Information Systems, Detroit.

Workshops (Peer Reviewed)

Weeger, A., and Gewald, H. and Gewald, C. 2016. "Is It That Only Money Matters? A Cross-national Analysis of Health Information System Usage," Pre-ICIS AIS SIG Health Workshop, Dublin.

Weeger, A., and Gewald, H. 2012. "Why do They Resist? Analyzing Physicians' Technology Adoption Behavior Using Social Cognitive Theory and the UTAUT-Model," Workshop on Health IT and Economics, Washington, D.C.

Weeger, A., and Gewald, H. and Vriesman, L. 2011. "Adoption or Resistance? Hospital Physicians' Acceptance of Electronic Medical Records," Workshop on Health IT and Economics, Washington, D.C.

