Aligning Effectively

ALIGNING EFFECTIVELY: THE CASE OF ELECTRONIC MEDICAL RECORDS

Research paper

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Abstract

Co-evolutionary IS-alignment (COISA) is a relatively new approach to understanding business-IT alignment (BITA) in complex environments. It is defined as continuously exercised alignment processes, characterized by co-evolutionary interactions between different IS stakeholders, in pursuit of a common interpretation and implementation of what it means to apply IT in an appropriate and timely way, in harmony with strategies, goals, and needs. This concept is well applicable in hospitals, given their many different stakeholders and quickly changing environments. For example, although hospitals heavily invest in advanced Electronic Medical Records (EMR), it remains unclear how EMR should align with the strategies, goals, and needs of hospitals and its stakeholders. Earlier work has shown that COISA may be a useful lens in revealing the manifestation of stakeholder interactions behind alignment during EMR implementations. However, it is insufficient only to assess the manifestation of COISA interactions, as this is no guarantee that these interactions are effective in pursuing alignment. Our study reveals facilitators of efficacious COISA interactions during EMR implementations, using theoretical insights on BITA, COISA and efficacious dynamics in complex organizations and empirical insights from a single case study and three focus groups. Our findings reconcile and complement existing knowledge, specifically for EMR implementations.

Keywords: Co-evolutionary IS-alignment, Electronic Medical Records, Business-IT alignment, Complex Adaptive Systems.

1 Introduction

In the past decade, contemporary hospitals have been implementing advanced, integrated Electonic Medical Records (EMR) at an unprecedented speed (Chang and Gupta, 2015; van Poelgeest et al., 2017). EMR consist of electronic repositories of medical histories of patients, which are maintained over time (Kohli and Tan, 2016). However, advanced EMR also provide additional functionalities, such as information integration across medical departments, complex healthcare process support, administrative support, and research support (Raghupathi and Tan, 2008; Sulaiman and Wickramasinghe, 2014; Walraven et al., 2019). This expansion of the reach and influence of EMR causes these EMR systems to be increasingly vital for a growing set of stakeholders. Moreover, hospitals face a complex environment due to quick technical developments in e-health, increasing patient expectations, and changing legislation (Liang et al., 2017; Miller and Tucker, 2009; Van de Wetering et al., 2018). Existing EMR implementation studies confirm that different stakeholder groups have different needs to leverage the benefits they experience from EMR (Goo et al., 2015; Sulaiman and Wickramasinghe, 2014; Walraven et al., 2019). However, the specific facilitators that are needed to reconcile these stakeholder needs into one single EMR as well as possible, are scarcely studied and do not explicitly focus on the complex and dynamic context surrounding these systems. Thus, the quest for alignment of EMR with strategies, goals, and needs of the hospital and its stakeholders is an increasingly complex, but crucial challenge that may benefit from novel approaches specifically designed for complexity (Benbya et al., 2020; Goo et al., 2015; Merali and McKelvey, 2006).

More general studies into business-IT alignment, or to apply IT in an appropriate and timely way (Ghosh and Scott, 2014; Heier et al., 2012; Li and Tan, 2013; Luftman and Kempaiah, 2007) have long recognized the need for a different approach to the alignment challenge given rapid change, unpredictability and blurring boundaries between business- and IS functions (as also seen in EMR implementations). (Benbya and McKelvey, 2006; Merali and McKelvey, 2006). These issues have led to calls for reconceptualization of alignment given complex conditions, including Ciborra (1997, p. 79), who argued for *"An enlarged notion of alignment within a hybrid network of semi-autonomous actors"* and Leonard (2008, p. 567), underlining that, given a continuous perspective on alignment, *"the alignment of an organisation's information systems to its needs should be characterized by identifying the specific groups of people and the specific technologies, involved in any organisational change."*

A stream of IS research that addresses these issues, is the complex adaptive systems (CAS)-based notion of co-evolutionary IS-alignment (COISA) (Allen and Varga, 2006; Amarilli et al., 2016; Benbya and McKelvey, 2006; Leonard, 2008; Walraven et al., 2018). In this research, alignment can be viewed as an interpretation and implementation, shared across different IS stakeholders, of what it means to apply IT in an appropriate and timely way. This interpretation and implementation, in its turn, emerges from co-evolutionary interactions between IS stakeholders within and between strategic, operational, and individual levels of the organization (Benbya and McKelvey, 2006). Furthermore, the notion of COISA is based on the viewpoint that organizations facing complex conditions have to respond with a critical degree of internal complexity to remain viable, i.e., the principle of requisite complexity (Benbya and McKelvey, 2006, p. 290). Specifically, organizations facing complex conditions may benefit from the application of certain CAS principles in the orchestration of stakeholders (Benbya and McKelvey, 2006; Zhang, Chen, Lyytinen, et al., 2019a).

Recently, a multiple case study on three successful hospital EMR implementations has shown that a CAS-based co-evolutionary perspective on alignment may indeed be a practical approach in understanding stakeholder interactions behind alignment during EMR system implementations (Walraven et al., 2019). In particular, this study takes a conceptual lens of COISA as interactions between IS stakeholders within and between alignment processes to illustrate how and where these interactions manifest in practice. An essential limitation of this particular work is that it is insufficient only to assess the manifestation of co-evolutionary interactions between stakeholders to comprehensively explore the value of COISA in the context of hospital EMR. Specifically, creating a two-way dialogue between different stakeholders in pursuit of a common interpretation an implementation of what it means to apply the

EMR system in an appropriate and timely way, does not necessarily imply that this common interpretation is, indeed, reached and maintained. In other words, it does not guarantee the manifestation of *efficacious* co-evolutionary interactions toward IS-alignment.

Based on the above, the present study aims to go beyond current COISA applications in healthcare and looks to explore efficacious co-evolutionary interactions between stakeholders toward alignment during EMR implementations. In doing so, we explore particular aspects that health IT practitioners could consider when striving for alignment and add to the knowledge base on co-evolutionary perspectives on business-IT alignment. Furthermore, we add to the knowledge base on effective EMR implementations by adding a new theoretical perspective that focuses on complex conditions to the existing insights in this particular field (Chen et al., 2019). Our work and line of reasoning are moreover congruent with the recent call for more case study research on business-IT co-evolution (Zhang, Chen, Lyytinen, et al., 2019a) and with the call for unraveling the process of IS business value generation (Schryen, 2013). Our research question is as follows:

RQ: *How can efficacious co-evolutionary interactions toward alignment be facilitated during Electronic Medical Records implementations in hospitals?*

To answer this question, we integrate existing conceptual insights on co-evolutionary (alignment) interactions to form a sound theoretical basis. Following, we conducted an interview-based single case study on an EMR implementation in a Dutch hospital. Finally, we performed three focus groups to deepen our case study findings and gain some additional perspectives: one focus group in another hospital that recently implemented a new EMR, and two focus groups with consultants specialized in healthcare IT and EMR implementations. In the remainder of this paper, we will first outline our theoretical framework. Then, we will explain our research methods, and finally, we will discuss our results, conclusions and make some suggestions for possible future research.

2 Theoretical framework

2.1 Complex Adaptive Systems and Co-evolutionary IS-alignment

As explained, the theoretical basis of COISA lies in CAS conceptualizations. A CAS can be viewed as a "*co-evolving multilayer network"* (Thurner et al., 2018). Core characteristics include that CASs exist of many different interacting elements and that the interactions between these elements in a CAS may change over time (Holland, 1995). Anderson (1999, p. 219) was among the first to apply CAS thinking to socio-technical organizations and stressed that the essence of this perspective is that *"[…] at any level of analysis, order is an emergent property of individual interactions at a lower level of aggregation".* Other characteristics that are in line with these ideas and often mentioned in existing literature include dynamism, interdependence, adaptation, connectivity, flow, non-linearity, self-organization, and co-evolution (Anderson, 1999; Holland, 1995; Onix et al., 2017).

Built upon this theoretical perspective, COISA is a relatively new approach to understanding and pursuing business-IT alignment (Amarilli et al., 2016; Zhang, Chen, Lyytinen, et al., 2019a). The work by Walraven et al. (2018) builds upon the insights of earlier co-evolutionary alignment studies (Amarilli et al., 2016, 2017; Benbya and McKelvey, 2006). This particular study identifies five different COISA processes in a structured literature review on alignment studies with a CAS perspective. Within and between these processes, heterogeneous IS stakeholders interact in co-evolutionary ways, pursuing alignment. We continue to use this perspective as a theoretical basis as it is developed specifically for complex conditions and has been empirically applied in an EMR context before (Walraven et al., 2019).

The alignment processes as mentioned above are visualized in Figure 1 and include Strategy formulation, Strategy Implementation, Enterprise Architecture Management (EAM), IT implementation, and IT usage. We base our definitions of the alignment processes (Table 1) on the work by Walraven et al. (2019) to ensure conceptual consistency. Furthermore, we define COISA here as: *Continuously exercised alignment processes, characterized by co-evolutionary interactions between different IS*

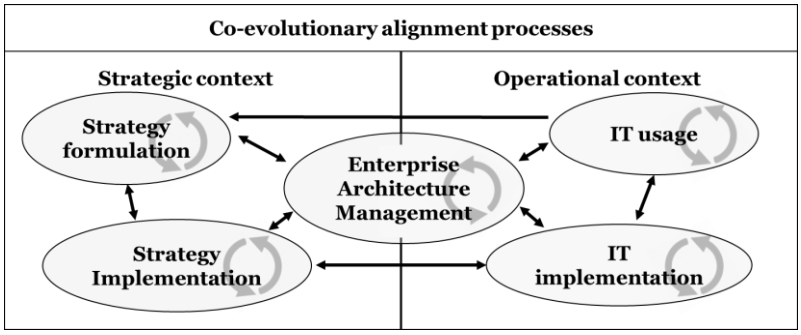

Figure 1. COISA processes characterized by co-evolutionary IS stakeholder interactions

stakeholders, in pursuit of a common interpretation and implementation of what it means to apply IT in an appropriate and timely way, in harmony with business strategies, goals, and needs. We thus respond to earlier criticisms on traditional alignment perspectives, by focusing on actors (IS stakeholders), and their networked, co-evolutionary interactions (Ciborra, 1997; Leonard, 2008).

Alignment process	Working definition
Strategy formulation	The process of defining strategic objectives underlying a particular IS
Strategy implementation	The process of setting up and maintaining structures and priorities to ensure that strategic objectives are realized in the operational context of the organization
EAM	The process of managing an organization's architecture
IT implementation	The process of embedding an IT solution within an organization
IT usage	The process of employing a system to perform a task

Table 1. Working definitions of COISA processes (adapted from Walraven et al.,(2019))

2.2 Facilitators of efficacious COISA interactions

We used a structured search strategy to get a comprehensive overview of the literature that may inform our study in terms of facilitators of efficacious COISA. In doing so, we searched the Web of Science database, covering an extensive range of scientific fields. From our search results, we selected articles that highlight in their title or abstract that they focus on indicators, mechanisms or factors that lead to alignment, emergent order, emergent patterns, or self-organization among actors in organizations.

The findings of this extensive literature search show that several authors have done relevant research in this particular area. For example, Amarilli et al. (2017) identify factors influencing co-evolutionary alignment mechanisms, including (1) triggers, (2) dynamic actors, (3) controlling parameters, and (4) enablers. These come from traditional BITA studies, not necessarily taking a co-evolutionary alignment perspective or focussing on complex conditions. Nonetheless, they may provide valuable insights for our current study as these authors do apply the identified factors to co-evolutionary alignment mechanisms and may thus be relevant in unveiling efficacious co-evolutionary interactions toward alignment.

A second strand of research that may be of interest to the current study includes complexity theory and CAS-inspired alignment literature (Benbya and McKelvey, 2006; Zhang, Chen, and Lyytinen, 2019a; Zhang, Chen, Lyytinen, et al., 2019b). Although mainly conceptual, the theoretical foundation of these works may be a promising direction to address the complexity in EMR alignment. These studies describe governance principles to enable efficacious co-evolutionary alignment, including deviation amplification, tension, rate of genetic variance, requisite complexity, near-decomposability, communication, resource allocation, and experimenting and learning (Benbya and McKelvey, 2006; Zhang, Chen and Lyytinen, 2019a). Some of these principles are integral to our foundational COISA framework. Namely, the principle of requisite complexity is addressed by our view that the whole of IS stakeholder interactions resembles a CAS and thus should be able to address environmental complexity (Zhang, Chen,

Lyytinen, et al., 2019a). Furthermore, deviation amplification, indicating "*Two species mutually reinforcing the adaptive success of the other"* (Benbya and McKelvey, 2006, p. 292), is inherent to the co-evolutionary nature of these interactions. The other principles may, however, be informative to identify the facilitators of efficacious COISA interactions.

A third research stream that has the potential to integrate and refine the abovementioned insights considers CAS- or complexity-inspired literature on efficacious decision-making in organizations facing complex conditions. (Campbell-Hunt, 2007; Eisenhardt and Sull, 2001; Grant, 2003, 2008; Mackey et al., 2006; McKelvey, 2001; Okhuysen and Eisenhardt, 2002; Rodon and Silva, 2015). These studies inherently focus on social and organizational aspects given complex conditions and use a theoretical foundation of complexity- and CAS studies. This notion resonates very well with the conceptualization of COISA as interactions between IS stakeholders in pursuit of alignment. Therefore, we use this stream of research to select and integrate the relevant findings of the first two strands of theory, as depicted in Figure 2.

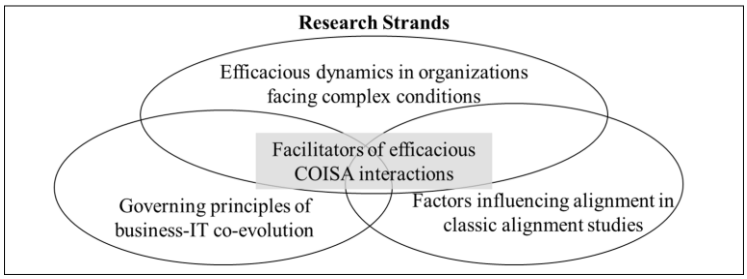

Figure 2. Strands of research taken into account in the theoretical framework

We followed a stage-based review approach in our study. In doing so, we used inductive coding techniques to identify the different facilitators mentioned across the literature (Saldaña, 2015) and thoroughly discussed the categorization of each specific facilitator among the research team. We finally identified two broad categories of facilitators in improving COISA efficacy. These categories are: (1) Facilitators that apply to IS stakeholders themselves and the co-evolutionary interactions between them, including adaptive tension, heterogeneity of actors and interconnections between actors; and (2) Facilitators considering the form or content of the types of intellectual alignment *decisions* emerging from these co-evolutionary interactions in specific alignment processes. These decisions, because of their form and content, may, in turn, benefit the efficacy of following COISA interactions. This category includes opting for a modular, flexible IT infrastructure (intellectual alignment decision in the EAM alignment process), defining strategy and architecture as simple rules (intellectual alignment decisions in the Strategy formulation & EAM processes) and balancing planned and emergent decision-making (intellectual alignment decisions in IT Implementation & Strategy Implementation processes). We will now elaborate on these categories and explain how they relate to existing work in each of the three described research strands.

2.2.1 Stakeholders & Interactions

Facilitators of efficacious interactions considering stakeholders and interactions tell us something about the motivations (adaptive tension) and means (heterogeneous actors, interconnections between actors) to initiate and continuously maintain co-evolutionary alignment processes among IS stakeholders. We will now elaborate on the theoretical foundations of these facilitators.

The first facilitator that is found in the existing literature is adaptive tension, which we define as the motivating force that causes co-evolutionary interactions in alignment processes to initiate and continue, i.e., Alignment Motivation. Several articles focusing on dynamics in human or socio-technical systems in general touch upon this subject. For example, in their article discussing the future of management given modern complexity, Grant (2008) argues for adaptive tension to be an essential focus of managers. McKelvey (2001) applies complexity theory to organizations and looks into how to leverage distributed intelligence (DI). This study also mentions adaptive tension as an important facilitator in this quest:

"Complexity science theory indicated that 'adaptive tension' dynamics […] may be used to foster adaptively efficacious [distributed intelligence] appreciation" (McKelvey, 2001). Grant (2003) mentions examples of actor motivators in co-evolutionary processes such as rigid periodic planning cycles and programmed targets. Benbya and McKelvey (2006) mention tension as something that managers should put upon an organization to enable efficacious co-evolutionary alignment interactions. Zhang et al. (2019a) also refer to adaptive tension and mention examples that can generate this tension, such as alignment actors sensing misalignments and managers imposing interactions among actors. Furthermore, triggers, i.e., *"events or conditions that give rise to alignment processes"* (Amarilli et al., 2017, p. 15), can also be interpreted as a form of adaptive tension, however emphasizing initiation more than the continuation of alignment processes. Based on the above, we conclude that adaptive tension for COISA is fundamentally about motivations that mobilize human actors to initiate and continue alignment processes. This motivation may be intrinsic, but it may also be externally provided by managers or by external actors.

A second facilitator that is crucial for efficacious co-evolutionary interactions in human or socio-technical systems considers including heterogeneous actors. For example, in their conceptual paper on creating requisite complexity in firms, Mackey et al. (2006) underline the importance of a diverse human system: *"If all the agents have similar abilities, there is no advantage to networking. […] end of story."* Campbell-Hunt (2007) studies the origins and evolution of strategy in organizations and conceptualize organizations active on this domain as CASs. In search of how efficacious decision-making manifests in these organizations, this author underlines the heterogeneity of the actors within this system to be of high importance. The concept of dynamic actors, i.e., *"the agents that realize alignment through actions on the IS, the organisation sub-system, and the business"*(Amarilli et al., 2017, p. 12) does not seem to put emphasis on the heterogeneity of actors, although these scholars do identify three clearly different forms of dynamic actors, i.e., top management committed to change, the IT champion *"[…] that combines business and IT competences"* and the external ecosystem, i.e., *"a combination of technology suppliers and consultants that compensate the lack of an internal IT champion and are capable of providing the necessary resources and skills to transform needs into actions, implement changes in the IT and organization sub-systems"* (Amarilli et al., 2017, p. 13). It remains implicit whether the inclusion of both business- and IT actors is beneficial for efficacious co-evolutionary interactions, although the CIO reporting to the CEO is mentioned as an enabler, advocating for this viewpoint. Benbya and McKelvey (2006) mention heterogeneous actors in one of their principles of efficacious adaptation in COISA, i.e., the rate of genetic variance. This principle refers to the inclusion of heterogeneous actors in terms of knowledge. Furthermore, the study on COISA in EMR implementations by Walraven et al. (2019) underlines the importance of inclusion of different stakeholder groups in COISA processes. Finally, Zhang et al. (2019a) touch upon the importance of human capital in their principle of resource allocation, which *"tends to re-configure existing resources or to build new resources to supplement current gaps in the organizational resource base"* (Zhang, Chen, Lyytinen, et al., 2019a, p. 6234). Concluding, heterogeneous actors are mentioned across the literature mentioned above strands, and thus, we propose this facilitator to be crucial for efficacious interactions in COISA.

Third, a critical facilitator considering stakeholders and interactions entails interconnections between actors. This topic is extensively discussed by Mackey et al. (2006), who argue for moderate networking, as the right balance between strong and weak-tie connections between actors. In this proposition, the idea of weak-tie bridges, quite literally *bridging* two heterogeneous (groups of) actors (Burt, 2009) is underlined as important in creating efficacious interactions. In the context of COISA, this directly relates to the importance of dynamic actors (Amarilli et al., 2017). Indeed, all described types of dynamic actors in this study have in common that they bridge the gap between business and IT. Furthermore Mackey et al. (2006, p. 10) emphasize the importance of face-to-face contact, advocating for *"[…] physical "mixing" events that bring heterogeneous agents into person-to-person contact."* Apart from the aforementioned connection with Amarilli et al. (2017), other business-IT co-evolution studies also refer to interconnections between actors. For example, Benbya and McKelvey (2006) underline the importance of knowledge flow between heterogeneous actors in their principle of the rate of genetic variance. Lastly,

Zhang et al. (2019a) mention communication as crucial for efficacious business-IT co-evolution. Concluding, interconnections between actors are deemed essential for efficacious COISA interactions, especially in terms of balancing strong and weak ties, "bridging" actors and face-to-face contact.

2.2.2 Form and content of intellectual alignment decisions

The second category of facilitators of efficacious COISA interactions entails the form and the content of intellectual alignment decisions, which in turn further benefit the co-evolutionary alignment interactions. These decisions can be divided into (1) infrastructure flexibility, (2) using simple rules to govern co-evolutionary interactions, and (3) balancing planned and emergent decision-making.

The first facilitator entails infrastructure flexibility, as highlighted by Amarilli et al. (2017). Examples of flexible infrastructures include having a modular system and using updated technology. This particular facilitator is considered an intellectual alignment decision, because defining a modular IT landscape is an architectural decision. Taking this decision and acting upon it, therefore, is done as part of co-evolutionary alignment interactions in the EAM process, but it does not inherently characterize the stakeholder interactions themselves.

The second facilitator in this category is the use of simple rules, which is addressed by several authors. Campbell-Hunt (2007) mention that these simple rules *"[…] are set free to adapt, add, and discontinue actions as a function of their effectiveness in social interaction."*. Eisenhardt and Sull (2001) go one step further and argue for strategy as simple rules, *"[…] providing just enough structure to allow it to capture the best opportunities*." This viewpoint is underlined by Grant (2003), while Grant (2008) further refines the idea of simple rules by explicating their goal of creating boundary conditions for decision-making. Okhuysen and Eisenhardt (2002) endorse this perspective in their study on group knowledge integration: *[…]simple formal interventions provide simple rules that act as a source of semi-structure […] that can help groups self-organize their improvement and pace their attention to both adapting and executing their task*." Literature considering business-IT co-evolution does not explicitly speak of simple rules for efficacious co-evolutionary alignment interactions. However, they may be a practical manifestation of the controlling parameters and enablers as introduced by (Amarilli et al., 2017). Controlling parameters reinforce or reduce dynamic actors' actions, while enablers motivate these dynamic actors to undertake transformative action in the different alignment processes.

The third facilitator in this category considers balancing planned and emergent decision-making. We define this facilitator as consciously balancing top-down decisions and bottom-up, emergent decisions. This facilitator is referred to in different ways in existing literature, e.g., as a combination of positive and negative feedback loops (Campbell-Hunt, 2007). Grant (2003) speaks of planned emergence, giving business units autonomy within constraints and guidelines as developed by corporate management. Mackey et al. (2006) apply these ideas by thinking about modularization not of IT systems, but of the organization itself, based on the idea that "*[…] systems […] evolve toward fitness fastest when the cells (modules) are nearly, but not totally, disconnected from higher levels in biological or social system hierarchies"*. Lastly, Rodon and Silva (2015) underline the importance of balance between planned and emergent decision-making in a healthcare information infrastructure setting. The topic of emergent decision-making is mentioned by Benbya and McKelvey (2006) in the principle of near decomposability, i.e., to find the right balance in subunit autonomy and centralized steering in alignment management. Zhang et al. (2019a) also mention bottom-up initiatives in their principle of experimenting and learning. Furthermore, these ideas tie in with the finding of Amarilli et al. (2017, p. 12) that the absence of strict and rigid procedures is an alignment enabler.

3 Research method

To answer our research question, we did a single case study of an EMR implementation in a top clinical hospital in the Netherlands, specifically focused on identifying the facilitators of efficacious alignment interactions across different stakeholders. This method enables us to investigate "*a contemporary phe-*

nomenon […] in depth and within its real-world context" (Yin, 2018, p. 15). Subsequently, we conducted three focus groups, one in a second hospital, and two with industry experts. These focus groups were conducted to deepen our insights from the single case study.

3.1 Case study

The studied hospital implemented a new EMR (System A) in 2018 because their old system reached end-of-life. The new system would have a large impact on the hospital as a whole, since the old system was, in many ways, tailor-made to the separate specialisms in this hospital. The new EMR consists of a standardized, integrated solution that has recently been implemented across many hospitals in the Netherlands. This hospital is thus, at least in the Dutch context, considered a typical case study, in line with recommendations by Yin (2018) to improve external validity. Apart from inpatient and outpatient records, the EMR also includes functionalities for specialist work processes and administrative support across specialisms. Thus, specialisms who were used to working in silos and with autonomy now had to harmonize their ways of working. Furthermore, although the system is highly standardized, compared to the old EMR of this hospital, hospital-specific configurations still have to be made during the implementation phase. On these configurations and their impacts on work processes, the involved stakeholders had to decide to optimize the alignment of the EMR with stakeholders' strategies, goals, and needs. The EMR was finally implemented within-time, within-budget, and within-scope. Table 2 shows the interviewed roles, along with their involvement in the different alignment processes.

Alignment process / **Interviewee**	Strategy formulation	Strategy Implementation	EAM	IT Implementation	IT Usage
Team leader patient portal				x	
Team member nursing records			x	x	x
Team leader nursing records	x	x	x	x	x
Team leader diagnostic specialisms				x	
Digital doctor			x	x	x
Project manager administration		x		x	
Project manager outpatient records		x		x	
Chief Medical Information Officer	x	x	x		
Internal program manager	x	x			
External program manager	x	x			

Table 2. Interviewees & their active involvement in alignment processes

Interviewees were selected so that medical, administrative, technical and external perspectives were represented, in line with recommendations of stakeholder-focused alignment studies (Pouloudi et al., 2016). We also aimed to interview at least two respondents for each COISA process, so that our conclusions are demonstrably applicable to the COISA model as a whole. Interviews lasted, on average one hour, and questions were based on the approach taken by Walraven et al. (2019), however, with a focus more on facilitators of efficacious COISA interaction instead of on manifestation of co-evolution itself. Analyzed documentation included planning documents, the program structure, and a report on program objectives and corresponding operational elaborations.

3.2 Focus groups

To deepen and evaluate our insights from the single case study, we performed three focus groups. Focus groups are a valuable addition to the individual interviews done in our single case study because they can bring different perspectives together in a discussion Morgan (1996). One focus group was conducted in a second hospital that recently implemented a new EMR, to see if similar facilitators are found as those in the first hospital. This focus group consisted of six participants, representing medical staff (2),

management (1), IT (1), and digital advisors (2), whose role explicitly considers the alignment of the EMR with hospital strategies, goals, and needs. A second focus group was done at a consulting firm specialized in healthcare IT, involving ten junior health IT consultants and one highly experienced health IT consultant, whose combined practical experience and recent education may provide interesting insights. The third focus group was conducted in yet another consulting firm specialized in EMR, involving four senior health IT consultants, whose insights are based on years of experience in the practice of EMR implementations. To prepare these focus groups, we set up a focus group protocol outlining the structure during the focus group. This structure was informed by the different alignment processes and the facilitator categories, as identified in our theoretical framework and our initial findings from the case study. We used theoretically informed guidelines to tailor the structure to the focus group set-up (Merton et al., 1990; Morgan, 1996; Stewart and Shamdasani, 2014). We asked three academics experienced in conducting focus groups to review our protocols and refined them accordingly.

3.3 Coding and analysis

All interviews and focus groups were recorded and transcribed. Additionally, pictures of paper input (notes written on post-its and flip overs) from the focus groups were added to the research data for further analysis. Coding was done by one of the researchers. To ensure the reliability of our analysis, we had regular meetings among the research team to talk about the coding process and analysis as the coder progressed, as recommended by Saldaña (2015), based on Burant et al. (2007) and Strauss (1987). We first coded the data inductively, identifying relevant facilitators of efficacious COISA interactions. For example, the following excerpt was coded with "Clear accountability": *"And appointing the problem owner. You are responsible, but also qualified to take decisions on this matter."* After this initial coding, we performed an additional analysis aiming to categorize all identified facilitators based on our theoretical framework. This analysis resulted in four overarching categories, which are a slight refinement compared to our original categorization, as presented in section 2. The final categories include (1) Alignment motivation, (2) Stakeholder involvement, (3) Interconnections, and (4) Alignment decisions.

4 Results

Table 3 shows our findings for each data collection method and category of facilitators. We will now elaborate on our findings.

4.1 Alignment motivation

The facilitator category Alignment motivation considers facilitators motivating IS stakeholders to engage in co-evolutionary interactions in a specific alignment process, answering the question: *"Why do we talk about this in the first place?"*. In this category, six facilitators were mentioned in all alignment processes and data collection methods. These facilitators include (1) Accountability & Mandate, (2) Planning & Monitoring, (3) Intrinsic motivation of actors, (4) Perceived EMR benefits, (5) (Prevention of) misalignments, and (6) Legal obligations. Accountability and mandate are particularly crucial in the EAM process, as responsibilities for processes crossing departmental boundaries are often not clearly assigned. Some facilitators were only mentioned in some alignment processes. These facilitators include (7) Support and leadership of Executive management, which was only mentioned for Strategy Formulation and EAM, (8) Compensate involved actors' time, mentioned for Strategy Implementation, EAM and IT usage and (9) End-user training, which was only mentioned for IT usage.

4.2 Stakeholder involvement

The category of stakeholder involvement involves facilitators related to the selection of actors to be involved in COISA processes, to ensure efficacious COISA interactions. In other words, the question to be answered here is: *"Who do we involve to ensure efficacy of alignment interactions?"*

Five facilitators in this category were mentioned in all alignment processes and different data collection

COISA process		Strategy Formulation				Strategy Implementation				EAM				IT Implementation				IT usage			
Data collection methods / Facilitators per category		A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
Alignment motivation	Accountability & Mandate		X		X		X		X	X	X	X	X	X	X		X	X		X	
	Planning & Monitoring	X	X		X	X		X	X	X			X	X			X	X	X		
	Intrinsic motivation actors	X						X		X	X	X	X	X	X	X				X	X
	Perceived EMR benefits		X	X	X			X	X			X				X	X			X	X
	(Prevention of) misalignments	X	X					X	X			X	X				X			X	X
	Legal obligations			X	X			X	X			X	X			X	X			X	
	Support & leadership executive management.					X	X		X			X									
	Compensation of involved actors' time						X					X								X	
	End user training																	X	X	X	
Stakeholder involvement	Different perspectives represented	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Internal & External actors	X	X	X	X	X	X	X	X			X	X	X	X	X	X				X
	Champions / motivators	X	X		X	X	X	X	X			X		X	X		X		X		X
	'Translators' and/or language unity		X			X				X	X		X	X	X		X	X		X	X
	Knowledge of EMR (im)possibilities				X		X	X	X					X	X	X	X		X		X
	"Unofficial" leaders		X		X		X	X	X			X	X			X	X				
	Openness to other perspectives		X		X			X			X	X			X						
	Leadership						X				X				X				X		
	Representatives of related projects					X		X					X								
	Representatives of related systems			X								X				X					
Interconnections	Formal governance	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Transparency		X		X		X		X		X	X	X		X		X		X		X
	Existing informal networks				X		X	X		X		X	X			X	X	X			X
	Supporting tools		X				X		X		X		X		X	X			X	X	
	Physical project spaces		X							X		X		X		X					
	Creating informal networks									X			X								
Alignment decisions	Common guidelines	X	X	X	X		X		X	X	X	X			X	X	X		X		X
	Central coordination						X	X	X		X	X	X		X	X	X				
	Allow emergent decision-making									X	X			X	X						
	Have technical infrastructure in place											X			X					X	

Table 3. Findings for Case study at first hospital (A); Focus group at second hospital (B); Focus group consultancy company 1 (C); Focus group consultancy company 2 (D)

methods. These facilitators include (1) Different perspectives represented (e.g., medical, IT, financial, quality management, etc.), (2) Internal & External actors, (3) Champions / motivators (4) 'Translators' and/or language unity, and (5) Knowledge of EMR (im)possibilities. Respondents from the various data collection methods unanimously agreed on the importance to include different perspectives to ensure all

perspectives are taken into account in the final decision-making process. As an illustration, the CMIO in our case study hospital pointed out: *"The managerial staff of the hospital mostly thinks in terms of process optimization. And that is not necessarily the only thing that we* [doctors] *are looking for"*. The specific perspectives to include in the discussed alignment processes may vary for each hospital, depending on hospital type, hospital size and organizational culture, according to the respondents. Involving a mix of internal and external actors was also underlined, to balance knowledge of the organization and external expertise based on earlier experience.

Two facilitators were mentioned across all alignment processes except IT usage, namely (6) "Unofficial" leaders and (7) Openness to perspectives. Regarding the involvement of "unofficial" leaders, one focus group C participant clarified: *"Make sure you know who the unofficial leaders are. Often, you see, for example that the youngest medical specialist in the department is involved in the project group, and not the medical specialist who is unofficially in charge within their department."*

Three facilitators in this category were brought up relatively sparsely, both in terms of alignment processes and data collection methods. These facilitators include (8) leadership, (9) representatives of related projects, and (10) representatives of related systems. A consultant in focus group D illustrated the importance of connecting with related projects: *"I have worked for a hospital that did a PACS implementation simultaneously to the EMR implementation. Those projects did not interact at all, while I think there are many interdependencies, and they should, in fact, interact with each other".*

4.3 Interconnections

Interconnections refer to the *means* that IS stakeholders have to engage in co-evolutionary alignment interactions, thus answering the question: *"By which means do we interact on making decisions on these topics among IS stakeholders to ensure the efficacy of alignment interactions?"*. Our findings reveal four facilitators of efficacious COISA interactions that are mentioned across all alignment processes in this category. These facilitators include (1) Formal governance (2) Transparency, (3) Existing informal networks, and (4) Supporting tools. Firstly, formal interconnections were deemed important to *"know where which knowledge is,"* as explained by one of the participants of focus group B, but also to ensure that support can be easily arranged. Furthermore, supporting tools to enable interconnections, work towards language unity and transparency in needs and decisions were deemed highly important. One of the participants of focus group B elaborated: *"We have implemented Sharepoint and that keeps improving, I view it more and more as a means to create unity of language"*. Existing informal networks are also highly relevant, as explained by one of the participants in the hospital focus group: "*There is a part that does not take place in formal organizational structures, but over coffee, and that is what I am talking about. If you want to be effective, you need coffee.*".

Two facilitators in this category are mentioned only in a few alignment processes. These facilitators include (5) Physical project spaces and (6) Creating informal networks. They seem to be especially crucial for EAM, where cross-departmental or cross-functional decisions that need to be taken by actors that normally do not often collaborate and thus where there are no existing informal networks in place. An example of the creation of informal networks for these issues considered the organization of "speed-dates" among program participants in our case study hospital, as explained by one of the interviewees: *"We had speed-dates among team leaders in our restaurant, so we all knew who was involved in the program. Every two minutes you got to talk to another team leader. And that feels really different than just having a list of names on paper."* Furthermore, in this case study hospital, a specific part of the hospital building was dedicated to people involved in the EMR implementation. In this building, because everyone was quite literally in close proximity to each other, informal networks were easily formed, and many issues could be quickly and easily resolved.

4.4 Alignment decisions

Some of the facilitators consider specific decisions that are taken in the alignment processes themselves, and that may, in turn, benefit following COISA interactions in those same processes. In other words, the

question to be answered here is: *"Which alignment-related decisions among IS stakeholders improve the efficacy of future alignment interactions?"* These facilitators include (1) Common guidelines, (2) Central coordination, (3) Allow emergent decision-making, and (4) Have technical infrastructure in place. We will now elaborate on these facilitators.

Firstly, the facilitator of having common guidelines is important to ensure co-evolution between decisions in strategic and EAM alignment processes and interactions in operational alignment processes. As explained by one of the medical participants of focus group B: *"It has to be compact and readable, because it has to appeal to people, it has to stick, people have to identify with it. You cannot come up with something and say, this is it, you have to create support."* Our case study findings confirm this combination of simplicity and communication: One project leader explained that strategic principles played a major role in their decision-making, while others were more neutral, finding the principles too general to really guide decisions or so self-explanatory that they deemed it unnecessary to pay extra attention to them in the process. Some interviewees were only vaguely aware of their existence.

Central coordination of alignment-related decision-making was mentioned by several respondents as well: "*I think it is important to have a central group of stakeholder representatives with a clear vision, who are not afraid to put the interests of the organization over their own, individual interests."* On the other hand, in our case study, there were some examples of successful emergent decision-making. For example, the team member nursing records explained that cardiac nurses themselves came up with the idea to connect to first aid nurses because they share many work processes and patients. Therefore, it seemed logical to them to standardize some EMR configurations for both departments so that the new EMR would support the already existing interdepartmental collaboration. Further inquiry shows us a combination of central and decentral decision-making: Looking at the broader program structure in the case study hospital and in the focus group hospital, we noticed in both hospitals a specific choice for a modular programme organization, where specialisms were authorized to make decisions for their own department locally, however, within centrally coordinated strategic and architectural boundaries.

The final facilitator that respondents identified in this category is having good supporting infrastructure in place. For example, a participant of focus group B explained: *"If you want to build on your software, you need sufficient testing environments, you need sufficient performance, et cetera."*

5 Discussion & Conclusion

Our empirical findings resonate with earlier work, however some specific findings of our study are new, as is discussed below.

5.1 Alignment motivators other than misalignments or managers

Earlier studies perceive adaptive tension to come mainly from management (Benbya and McKelvey, 2006; Grant, 2003, 2008) or from actors sensing misalignments (Amarilli et al., 2017), which both motivate actors to engage in alignment interactions. Our findings suggest that these motivations may also come from legal obligations and perceived EMR benefits. Perceived EMR benefits are addressed in earlier studies as the personification of the IT champion (Amarilli et al., 2017), who actively stands for these benefits. However, our study suggests that actors who perceive EMR benefits and are thus intrinsically motivated to engage in alignment interactions are not necessarily champions who take the lead in communicating these benefits to others.

5.2 Inclusion of heterogeneous, but also specific actors

Existing studies suggests that it is crucial to include heterogeneous actors (Benbya and McKelvey, 2006; Campbell-Hunt, 2007; Mackey et al., 2006), and to have champions and 'dynamic actors,' bridging the gap between business and IT (Amarilli et al., 2017). Our study confirms these insights, but also adds to this perspective by underlining the importance of including specific actors. These include 'informal'

leaders (addressing existing power relationships) (Cross et al., 2004) and actors that are not only able to represent their perspective but who are also open to understanding different perspectives.

5.3 Supporting communication tools and process-specific needs

In terms of interconnections, existing studies remain quite general and underline the importance of communication (Zhang, Chen and Lyytinen, 2019a), balancing strong and "weak-tie" bridges (Burt, 2009) and of conscious efforts to create informal networks (Mackey et al., 2006). We confirm these insights, and add to them by the strong indication of the importance of communicating transparently and of having a clear formal governance structure with well-defined responsibilities. Furthermore, supporting tools such as Sharepoint are found to be important in our study, but are not explicitly mentioned in earlier works. Lastly, we found that organizing activities to create informal networks is specifically essential for EAM. This outcome may be explained by the fact that this is where cross-departmental, cross-system and cross-functional decisions are made among actors that normally do not collaborate often and where informal networks thus do not yet exist as they do within departments.

5.4 Supporting infrastructure, but not necessarily flexible?

The alignment decisions that were identified in our theoretical framework, combining bottom-up and top-down decision-making and having clear common guidelines (Campbell-Hunt, 2007; Eisenhardt and Sull, 2001; Grant, 2003; Rodon and Silva, 2015), are confirmed in our study. Furthermore, having a good supporting infrastructure in place was also recognized, however, not necessarily in terms of flexibility or modularity. This may still have played a role because the EMR systems that were implemented and discussed were in fact, modular. Therefore, respondents may not have recognized this as explicitly beneficial because they may not be familiar with non-modular systems as a comparison.

5.5 Implications, limitations and future work

Our study suggests specific facilitators for efficacious COISA interactions during hospital EMR implementations, based on a single case study and three focus groups. In doing so, we answer to the recent call for more empirical studies on business-IT co-evolution (Zhang, Chen, Lyytinen, et al., 2019a). We selected and integrated existing theoretical insights on efficacious interactions in socio-technical systems with studies on business-IT alignment and COISA to form an integral theoretical framework and build upon existing COISA studies. In this effort, we explicitly respond to earlier criticisms on traditional alignment perspectives, by focusing on actors and their networked, co-evolutionary interactions (Ciborra, 1997; Leonard, 2008). Furthermore, we are the first to explicitly connect insights on efficacious alignment interactions to the COISA processes that have been empirically demonstrated to be relevant in EMR implementations (Walraven et al., 2019). Our findings are particularly valuable to practitioners in hospital EMR implementations. Namely, they can use our findings as guidelines to enhance alignment-related decision-making given internal and external complexity by evaluating their existing alignment mechanisms based on the suggestions in this research and improve them accordingly.

The study is not without limitations. First, we focus on a single system, i.e., EMR. Although these systems are large and comprehensive and thus may be seen as typical for systems facing complexity, further research is needed to determine whether our findings apply to other systems in complex conditions. Moreover, we focused on the implementation phase of the EMR. Although this is a critical phase, future studies could take a longitudinal approach, also taking into account EMR operations. Furthermore, we only did one round of focus groups, which were exploratory in nature. It would be interesting to do some additional confirmatory iterations (Stewart and Shamdasani, 2014, p. 41) to refine and strengthen our findings. Lastly, this study chose not to concentrate on specific outcomes of COISA given complex conditions. Future studies could focus on the specific pathways to operational value by, e.g., looking at market agility, technological competences, dynamic capabilities, possibly also using configurational perspectives (Van de Wetering, 2019).

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