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An Explanatory Study on the Co-evolutionary Mechanisms of Business IT Alignment

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Completed Research Paper

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Abstract

Business IT Alignment is considered an enduring topic in academic and practitioners' literature. The interest in the subject is justified by the link, demonstrated by several studies, between alignment and corporate performances. However, alignment research has not yet been translated into practices, theoretically demonstrated in literature and applied to companies. The interpretation of alignment as a function of independent factors and the underestimation of the complex nature of alignment process are considered key barriers in alignment achievement. The present study is based on a multi-case study analysis carried out in two companies that implemented alignment processes. We conceptualise alignment as a co-evolution process and derive four mechanisms and three types of parameters and explain their role in alignment implementation. The contribution is theoretical, since we analyse and describe mechanisms and factors that govern alignment, and for the practitioners, since knowledge of these mechanisms is precondition for an effective alignment implementation.

Keywords: Business-IT Alignment, Complexity theory, Co-evolution

Introduction

Since the introduction of Information Technology (IT) into companies, the alignment between IT and corporate business (hereafter alignment) has drawn the attention of researchers and practitioners (Henderson and Venkatraman 1993; Chan 2002; Chan and Reich 2007). The motivation for this enduring interest in the topic lies in the superior business performances, demonstrated by several studies (Avison et al. 2004; Croteau and Bergeron 2001), attributed to companies characterised by a higher degree of alignment (Venkatraman 1989, Coltman et al. 2015). However, despite an extensive body of knowledge spanning over three decades (Chan 2002; Chan and Reich 2007; Coltman et al. 2015; Hiekkanen et al. 2013; Ullah and Lai 2013), alignment is still considered an unachieved objective in companies (Kappelman et al. 2013; Kappelman et al. 2014; Silvius et al. 2009).

Alignment has been conceptualised in literature in several forms, highlighting its different dimensions (Coltman et al. 2015; Reich and Benbasat 2000; Gerow et al. 2016). Strategic, social, and operational have been the most widely investigated dimensions of alignment. For each of them studies have mainly adopted a variance theory approach of explanation (Chan and Reich 2007; Baker et al. 2011) where the factors determining or influencing alignment dimensions, in terms of enablers and inhibitors, are ascertained. The relationships between factors and alignment dimensions have been described through linear, cause-effect connections. These descriptions of alignment have been critically scrutinised in literature due to the limited capacity of capturing the complexity of reality (Maes et al. 2000; Oh and Pinsonneault 2007; Luftman et al. 2017) and, as a consequence, for the claimed low implications in guiding an effective alignment implementation (Peppard et al. 2014; Tallon and Kraemer 2003; Luftman et al. 2017).

In an attempt to overcome the limitation of approaches to the study of alignment, the interpretation of corporate Information System (IS) as a socio-technical system (McBride 2005; Merali 2006; Lee et al. 2008) triggered a new stream of research, where principles and tools of complexity science have been applied to the study of IS and to its alignment with business. This novel approach explains alignment as a co-evolution phenomenon involving IS and business (Benbya and McKelvey 2006; Peppard and Campbell 2014; Vessey and Ward 2013) in a process of mutual adaptation. However, co-evolution studies of alignment have mainly adopted a descriptive perspective and were principally aimed at demonstrating the applicability of co-evolution theory to the domain of IS rather than providing explanations on how alignment is implemented (Kallinikos 2006; Silvius et al. 2009). Therefore, literature lacks an explanatory theory that describes the mechanisms that govern alignment implementation and the relationship with the factors influencing it.

We argue that, in order to improve alignment implementation in organisation, a deeper investigation into the dynamics of alignment, i.e. how alignment occurs in organisations, which forces and factors influence alignment and how they are connected, is required. The paper addresses this challenge by asking the following Research Questions:

(1) What are the mechanisms that govern alignment implementation within an organisation?

(2) What are the factors that influence alignment and what are their roles in the alignment process?

The research is based on an initial analysis of the literature, aimed at identifying the constructs and a set of factors potentially capable of affecting alignment. Publications that classify the factors influencing alignment and identify their form of influence have been selected A multi-case study analysis involving two alignment processes in organisations enabled the selection of the relevant parameters and the investigation of the mechanisms leading to alignment. Co-evolution theory has been chosen as explanatory theory (Yin 1994; Gregor 2006) and was used during the phase of research design for crafting the instruments and protocols of investigation (Eisenhardt 1989; Yin 1994) as well as during the interpretation of findings.

As a result of the study, we derive four mechanisms influencing alignment in companies, namely business influence on organisations, transformation of business needs into IT requirements, adjustments in the organisation, transformation of the business, and three types of factors, namely dynamic actors, enablers, and controlling parameters, and explain their role in the alignment implementation.

The remainder of the paper is organised as follows. The following section provides the theoretical background of the study, underlines the limitations of extant literature, and identifies the conceptual models used in our research. The subsequent section illustrates the case study approach adopted as methodology of study. Findings on alignment mechanisms and influencing factors derived from the case studies are then presented. The last section comments on the findings, highlights the implications for research and practice, underlines limitations, and suggests directions for future research.

Theoretical Background

Complementary Perspectives of Alignment

Alignment has been conceptualised in the literature in several forms. The Strategic Alignment Model (SAM) proposed by Henderson and Venkatraman (1993) is credited for being the first and most extensively accepted reference framework for classifying alignment. According to the SAM, company's alignment emerges from the fit among four domains: Business Strategy, IT Strategy, Organizational Infrastructure

and Processes, and IT Infrastructure and Processes. The links between these domains gives rise to six dimensions of alignment, with the *social*, *strategic* (or intellectual), and *operational* dimensions being the most extensively investigated ones (Lee et al. 2008; Gerow et al. 2016; Schlosser et al. 2015). Social alignment refers to the mutual understanding and communication between business and IT personnel (Chan and Reich 2007; Reich and Benbasat 2000). Strategic alignment is "the degree to which the IT mission, objectives, and plans support and are supported by the business mission, objectives, and plans" (Reich and Benbasat 1996, p. 56) and focuses on the coordination between strategy plans and IT plans. Operational alignment is the fit between business and IT infrastructure and processes (Gerow et al. 2014; Wagner et al. 2014).

The dimensions of alignment have been deeply analysed in several studies that identified the influencing factors and their relationship with alignment (Chan et al. 2006; Gerow et al. 2016; Chan 2002; Reich and Benbasat 2000), investigated the mutual influence between alignment dimensions (Gerow et al. 2015; Schlosser et al. 2012), and described the evolution of alignment in organisations (Sabherwal et al. 2001; Wang et al. 2011). Due to the objective of our research, we oriented our literature analysis on publications focused on understanding and capable of explaining the mechanisms that determine alignment. The initial set of publications was identified through keywords search (alignment and its dimensions) in the journals listed in the College of Senior Scholars 'basket of eight' of the AIS. A second source of literature included publications in journals and conference proceedings in the Management Information Systems, Organization Science, and Complexity Science, identified through analysis of the references of the first set. The studies selected address all the key dimensions of alignment.

Literature on alignment has converged on two distinct and complementary conceptualizations of alignment: alignment as a state and alignment as a process (Chan and Reich 2007; Baker et al. 2011; Karpovsky and Galliers 2015). Alignment as a state assumes that alignment is a condition of the company that can be measured at a given point in time. The alignment as a process perspective considers the alignment as a sequence of continuous actions per formed by actors in the company at different levels. In this paper we adopt the following process-oriented interpretation of alignment (Maes et al. 2000, p. 19): "alignment is the continuous process, involving management and design sub-processes, of consciously and coherently interrelating all components of the business-IT relationship in order to contribute to the organisation's performance over time".

Studies adopting the alignment as a state perspective make use of a variance theory (Morris 2005) to identify the factors that promote or inhibit alignment. The focus of the studies is on the factors and on their functional contribution to alignment (Venkatramen 1989). Factors are analysed as independent variables and their mutual influence is investigated to a limited extent (Chan and Reich 2007). Table 1 exhibits the selection of factors identified in the literature adopting a variance theory perspective of alignment. Due to the similarities and overlapping of some factors, authors propose to re-classify and group them (Trienekens et al. 2014; Gutierrez et al. 2009; De Haes and Van Grembergen 2009). Based on these studies, factors have been classified into the following groups: shared domain knowledge, commitment, communication, confidence, IT/IS history, governance practices, collaboration, culture, leadership. Factors of the studies that were not under the control of the company (e.g. environment), have not been considered.

Study	Alignment dimension	Influence on alignment	Factors [a, b]	Group
Luftman et al. (1999)	Strategic alignment	Enablers with direct impact on alignment	1. Senior executive support for IT	Commitment
			2. IT (personnel) involved in strategy development	Governance practice
			3. IT (personnel) understands the business	Shared domain knowledge
			4. Business - IT partnership	Collaboration
			5. Well-prioritization of IT projects	Governance practice
			6. IT (personnel) demonstrates leadership	Leadership
Reich and Benbasat (2000)	Social alignment	Antecedents influencing current practices of alignment	1. Shared domain knowledge	Shared domain knowledge
			2. IT implementation success	IT/IS history
			3. Communication business-IT personnel	Communication
			4 Connection between business and IT processes	Communication
Preston and Karahanna (2009)	Strategic alignment	Network of cause-effect influences, affecting shared understanding as sole influencer ('proximate antecedent') of alignment	- Relational similarity	Culture
			- Systems of knowing	Communication
			- CIO educational mechanisms	Culture
			- Shared language	Shared domain knowledge
			- Shared domain knowledge	Shared domain knowledge
			- Shared understanding	Shared domain knowledge
Chan and Sabherwal (2006)	Strategic alignment	Antecedents that affect directly alignment	1. Shared domain knowledge	Shared domain knowledge
			2. Planning	Governance practice
			3. Sophistication	Culture
			4. Prior IS success	IT/IS history
			5. Organizational size [b]	
			6. Environmental uncertainty [b]	
Teo and Ang (1999)	Strategic alignment	Critical Success Factors (CSF) that influence alignment. Different mechanisms for explaining the influence of each CSF	1. Top management commitment to strategic use of IT	Commitment
			2. IS management knowledge about business	Shared domain knowledge
			3. Top management confidence in the IS department	Confidence
			4. IS department provides quick, reliable services to users	IS/IS history
			5. Frequent communication between user and IS dpt.	Communication
			6. The IS staff are able to keep up with advances in IT	Culture

			7. Prioritization of applications development	Governance practice
			8. Business objectives made known to IS management	Collaboration
			9. The IS department is responsive to user needs	Shared domain knowledge
			10. Top management is knowledgeable about IT	Shared domain knowledge
De Haes and van Grembergen (2009)	All alignment dimensions	Focus on governance practices ('minimum baseline' for alignment)	1. IT steering committee	Governance practice
			2. CIO on executive committee	Governance practice
			3. IT portfolio management	Governance practice
			4. IT budget control and reporting	Governance practice
			5. IT strategy committee	Governance practice
			6. Strategic IS planning	Governance practice
			7. IT leadership	Leadership
			8. CIO reporting to CEO or COO	Governance practice
			9. IT project steering committee	Governance practice
			10. Project management methodologies	Governance practice
Alaceva and Ruzu (2015)	Strategic alignment	19 barriers to alignment identified, grouped into 5 main categories.	1. Understanding of counterpart's environment	Shared domain knowledge
			2 Poor communication	Communication
			3 Unclear specifications	Communication
			4. Limited cooperation	Collaboration
			5. Lack of mutual commitment and support	Commitment
Chung et al. (2003)	Strategic, operational alignment	Role of flexibility in strategic alignment and application implementation	- Compatibility - Modularity - Connectivity	Infrastructure flexibility
			- IT personnel flexibility	Culture
Hussin et al. (2002)	All alignment dimensions	Moderation approach to test alignment factors in SMEs	- IT sophisticated practices	Governance practice
			- CEO commitment	Commitment
			- External IT expertise	Culture
Schlosser et al. (2015)	Social alignment	Mechanisms affecting business-IT understanding	IT governance mechanisms: - formal integration mechanisms - informal integration mechanisms	Governance practices
[a] Where present, number indicates priority [b] Some of the factors are out of organisation control and have not been classified				

Table 1. Factors Influencing Alignment

In the process conceptualization, alignment is described as a sequence of actions of mutual adaptation between IT and business (Karpovsky and Galliers 2015; Smaczny 2001). The process perspective taps into the theory of complexity science and in particular into the co-evolutionary theory to gain insights on how alignment occurs and to derive suggestions for its implementation (Benbya and McKelvey 2006; Courtney et al. 2008; Jacucci et al. 2006; Lee et al. 2008; McBride 2005; Merali 2006; Merali 2007; Merali and McKelvey 2006). Co-evolution is chosen since it well captures some acknowledged characteristics of organizations, such as the dynamicity of their behaviour, the feedback relationships between actions, the non-linearity between causes and effects, the self-organization of internal structure, the emergence of properties of the organization that are based on interaction of elements at lower levels (Peppard and Campbell 2014; Vessey and Ward 2013). Alignment is considered a property of a company that emerges from the interaction and mutual adaptation of different actors at different levels: individual, organization, and strategy (Benbya and McKelvey 2006). The difficulty in deriving the emergent behaviour of a complex system is the consequence of the links between the elements constituting a complex system, non-linear and governed by feedback loops (Merali 2006; Benbya and McKelvey 2006).

Limitations of both the state and the process perspectives have been identified. The alignment as a state perspective was criticized for its inability to describe the complex and non-linear relationship existing between the factors and the resulting alignment state (Chan and Reich 2007). These studies describe alignment through a static relationship and do not sufficiently analyse the scope and variance of activities through which the alignment is achieved (Luftman et al. 2017). Furthermore, the state conceptualization does not reflect the reality of companies that operate in constantly changing business environment and therefore continuously re-adjust their IS (Chan and Reich 2007; Baker et al. 2011).

Despite providing response to some of the limitations of the state perspective, the process description of alignment is not without criticism. Alignment is presented as the result of mutual adjustments performed by actors in a company, but the types of interactions, the influencing factors and their relationships are not investigated (Silvius et al. 2009; Luftman et al. 2017). Studies exploiting the co-evolutionary perspective are considered excessively descriptive and more oriented towards proving the applicability of the theory to the study of IS rather than explaining how alignment is achieved (Kallinikos 2006).

Conceptual Model of Alignment

Contributions for the investigation of the mechanisms of alignment have been derived from both state and process literature. Studies adopting the state perspective suggested an extensive set of factors that exert alignment. The difference between the factors is not always clear (Chan and Reich 2007), some factors slightly overlap, and similar terms are used with different meanings. Clustering criteria have been adopted to group factors exhibiting similar characteristics. The groups have been used for the investigation through case studies.

Process literature provided the initial constructs of alignment. Based on systems theory and subsequently on complexity science, authors investigated some of the properties of the IS as emerging from the interaction of its components (Benbya and McKelvey 2006; Merali 2006; Vessey and Ward 2013). A system is described as a composition of interacting components (Nevo and Wade 2010). Both the components and the system possess properties, which are emergent in the sense that they are derived from the properties and the interaction of the components.

The interpretation of an organisation and its IS as complex systems triggered a stream of research where some of the systems properties, including alignment, were explained through the interaction among the organisation and IS components. An organisation and an IS exhibit a number of characteristics of complex systems (Merali 2006, Benbya and McKelvey 2006), such as the structure composed of several interacting elements, and the behaviour resulting from the mutual adjustment of the elements, governed by non-linear feedbacks, leading to self-organisation (i.e. the spontaneous generation of new internal structures and forms of behaviour). Lee et al. (2008) present the organization as a socio-technical system where alignment is achieved through two types of interactions: social interaction, i.e. interactions between the personnel, and technical interactions, i.e. the functional integration of business and IT domains. Allen and Varga (2006) describe how the evolution of IS and organisation is the result of a continuous interaction carried out at a microscopic level and involving each person in the organisation utilising the IS. Karpovsky and Galliers (2015) consider alignment as the result of alignment activities carried out by different organisational actors. four types of actions are identified according to the focus of alignment, which is

connected to the dimensions of alignment addressed, and the purpose of alignment (intended or emergent): aligning as translation, aligning as integration, aligning as adaptation, and aligning as experience.
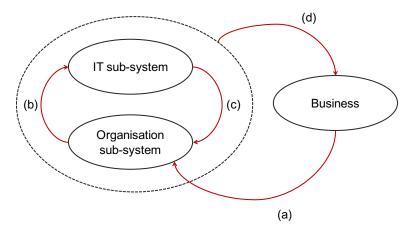

Figure 1. Conceptual Model for Alignment Mechanisms

The evolution of alignment in an organisation is described through co-evolutionary theories, derived from complexity science. Meyer et al. (2005) introduce the concept of non-linear behaviours of organisations when they are not in a stable condition of equilibrium. Sabherwal et al. (2001) describe the dynamics of alignment using a punctuated equilibrium model which argues that 'periods of gradual (alignment) evolution are punctuated by sudden revolutionary changes' (p. 180). Consistently with previous interpretations, Amarilli et al (2016) propose a description of alignment as the result of different types of interactions between three sub-systems of the organization (Figure 1): the business, that comprises the products and services realized and the business model of the company, the social component, i.e. the personnel of the organization, and the IS, that comprises the IT resources (hardware and software) of the company. The conceptual model of interaction between these sub-components, adopted for investigating the mechanisms of alignment implementation, foresees the following interactions (Figure 1): the business challenges the personnel to innovate the IS (mechanism a): the social component of the organization acts on the IS (mechanism b) and adapts to its changes (mechanism c); the business can leverage and take advantage of the IS to be transformed (mechanism d).

Methodology of Research

In our study we aim at explaining how alignment is achieved in organizations through the identification of the exerting factors and the description of their relationship with the alignment process. We use co-evolutionary theory as an explanatory theory, e.g. to explain, through causal relationships, and predict properties or behaviour of the system (Gregor 2006). In the study we do not test predictions. Rather, we aim at understanding "how the world can be seen in a certain way, with the aim of bringing about an altered understanding of how things are and why they are as they are" (Gregor 2006, p. 624).

The nature of the Research Questions suggested the adoption of a methodology of investigation based on case studies. Even though Research Questions are formulated in terms of 'what', the notion of mechanism contained in the questions refers to the explanation of 'how things happen' (Craver and Tabery 2015) and case studies represent an appropriate approach when 'how' questions are investigated (Yin 1994; Pare 2004). Furthermore, case study methodology provides distinctive advantages against other strategies when qualitative research questions with understanding objectives are being asked about a contemporary set of events in the real world context where the investigator has limited or no control (Yin 1994).

The research methodology foresaw a multiple-case and embedded study (Yin 1994). Multiple-case, i.e. the study of several cases, was motivated by (i) the awareness that evidence from different cases can be considered more compelling, leading to more robust conclusions (Herriot and Firestone 1983), and (ii) the possibility to apply a replication logic of analysis. Embedded refers to the deep level of analysis within the case.

Research Design

The formulation of the Research Questions suggested to identify as unit of analysis the process of alignment implementation in organisations, that have undertaken or are experiencing some transformation projects of the Information System with the objective of improving their alignment with business. The "perimeter" of the case was therefore the perimeter of the process.

Two companies were identified through a multi-step selection procedure. An initial set of 37 companies have been identified through the authors' connections. A selection has been made based on three main criteria. We selected companies operating in businesses that exhibited similar degree of dynamicity (based on the analysis of the dynamicity of the competitive environment), exhibiting sufficient complexity of the organisation, and presenting homogeneity in terms of the role of IT (in the selected companies, IT resources are considered supporting resources and are not components of the final products). The choice was motivated by the need to compare similar cases and improve generalizability of results (Yin 1994; Walsham 2006). Then the richness of data, also in a historical perspective, and their accessibility by the authors, i.e. the possibility to collect information through direct interviews or indirect sources of information, were used to fine-tune the selection. The two companies analysed are described below.

Company 1. The company, established in 1950, manufactures solutions for heating, climate control and industrial and process applications. Part of the production (burners, heating and renewable systems) is produced in the Italian plants, while air conditioning solutions are realised by outsourcing companies abroad. Products are sold to end users (families) through a network of re-sellers, mainly composed by professionals. The company belongs to an entrepreneurial family, has a turnover (2015) of around 60 million Euro, and employs around 180 employees.

Company 2. The company was created in 1954 in Italy and operates in the market for sports food supplements and functional nutrition. With a turnover of around 50 million Euro in 2015 and almost 200 employees, the company produces and distributes products mainly at national level, but has recently undertaken an internationalization process in order to serve other European countries. The company belongs to an entrepreneurial family and is listed in the stock market.

Data Collection

We conducted field research over a period of 12 months, from November 2015 to October 2016, collecting data on the two cases. Primary sources of data were interviews with key informants in the companies. 15 interviews have been organised (some key informants have been interviewed more than once in different phases of the alignment projects). Secondary sources of information comprised data from public communication (available through companies' websites and journals), internal reports, requests for proposals prepared for software selection processes, and meetings' memos. Different types of data from different sources provided triangulation and increased reliability of the information gathered during interviews (Kaplan and Duchon 1988; Miller et al. 1997). Data were collected with a longitudinal approach covering the previous three years of the company history. Consistently with well-established case study research methodology (Yin 1994), an interview protocol has been defined before interviews. The protocol was based on semi-structured questions that served as guidelines in the interview implementation. Interviews were arranged at higher levels of the organizations (owner, president, CEO, CIO), when possible, at lower levels (line managers and employees), and in some cases with stakeholders (e.g. consultants). The knowledge base of the study is described in Table 2.

Company	Primary sources (interviews)	Secondary sources
Company 1	- CEO and Sales manager (2 interviews) - CIO (3 interviews) - Head of Operations - CFO - R&D & Product Design manager - External IT consulting firm	- Documentation produced internally to support the design of the new IS - Results on survey on perception of alignment, conducted during the implementation of the IS - Information available through financial press - Meetings memos

Company 2	- President and CEO - CFO - CIO (2 interviews) - System Architect and IT help desk - Operations manager	- Reports from financial news - Corporate communications - Balance sheets - Internal reports and RFQ (Requests for Quotation) for software selection - Meetings memos

Table 2. Case Studies and Sources of Information

Co-evolutionary theory was chosen as preliminary theory for the case study design phase. According to several authors (Patton 1990; Yin 1994), the adoption of a preliminary theory in qualitative analysis, and in case study in particular, helps researchers design the interview protocol, guide and focus interviews, create a descriptive framework for data analysis, and generalise findings. Co-evolution theory focuses on the mutual adjustments of the companies' components (Peppard and Campbell 2014, Peppard and Breu 2003, Benbya and McKelvey 2007) and well fits the interpretation of their alignment as a sequence of adjustments steps over time. Conceptualisation of alignment as a co-evolution process gave suggestions for the choice of the interview protocol questions as well as for the interpretation of findings.

Data were collected following a process research approach. According to Mohr (1982) and Langley (1999), process theory, in contrast to variance theory, is concerned with understanding 'how things evolve over time and why they evolve in a specific way'. While variance theory provides an explanation of phenomena in terms of relationships among dependent (or state) variables and independent variables, process theory aims at describing the mechanisms that link variables and therefore at explaining the evolution of the phenomena of interest. Process theory is based on the collection of data on stories, i.e. sequences of activities and events and on actors influencing them. Temporal ordering and interaction between variables are key in process theory (Mohr 1982).

Data Analysis

Given the nature of the study, we combined different steps of sense-making (Langley 1999), by moving back and forth between literature, empirical data, and theoretical conceptualization. Preliminary literature analysis on co-evolutionary theory of alignment provided the first key concepts that were used to interpret data from case studies. A set of codes at three levels of analysis was created to analyse the data (Table 3). Elaboration of information from interviews and secondary sources provided input for theoretical conceptualizations and new literature study in an iterative manner.

Aggregate dimension	1st Order concepts	2nd Order concepts (codes)
Types and characteristics of Complex System	Structural complexity	Agents, elements, atoms, network, interaction, feedback loops, multi-scale systems.
	Behavioural complexity	Emergence, co-evolution, self-organization, homeostasis, system dynamics.
Mechanisms and factors influencing alignment	Projects origination	Origin, pressure, trigger, begin, start.
	Key roles	Roles, actuators, influence.
	Enablers	Pre-conditions, enablers, catalyser.
	Barriers	Obstacles, difficulties, barriers.
	Monitoring system	Monitoring, sensor, control system.
	Mechanisms	Mediation, moderation, linearity, non-linearity, cause-effect.

Table 3. Coding Systems Used in the Analysis of Case Studies

In the elaboration of data from case studies, we followed a narrative strategy that involved developing a story from raw data (Langley 1999). We used transcripts of the interviews and background documents to create a narrative history of the alignment processes in the two case studies. This approach is considered more appropriate to capture the dynamics of alignment and create a process theory (Langley 1999). Chains

of events were therefore created and the variables that triggered or influenced the evolution of alignment in companies were recorded.

Findings

Alignment Mechanisms

Following a processual analysis theory (Pettigrew 1997; Eisenhardt 1989; Langley 1999), data from interviews were used to re-construct the evolution of alignment in organisations over time. Patterns were searched for in the alignment processes and common features in the two cases were identified and compared. The underlying mechanisms were investigated with a combination of deductive and inductive approaches (Pettigrew 1997). Literature interpreting companies as complex systems provided a conceptual framework for understanding the mechanisms that determine alignment in organisations (Lee et al 2008; Amarilli et al. 2016; Benbya and McKelvey 2006; Allen and Varga (2006). In each company the interactions among three main sub-systems (business, organisation sub-system, and IT sub-system) were scrutinised in terms of impact on alignment and influencing factors. The parameters identified through the analysis of the literature adopting a state perspective (Table 1) were used to identify the candidate factors that influenced the alignment dynamics.

Company 1 manufactures products characterised by standardization and replicability and competes in a stable business environment. The IS has been managed for several years by an IT manager who, despite a direct report to the CEO and the CEO commitment to IT, managed the evolution of the existing legacy system with an incremental approach, based on adding new features to match specific requirements expressed by business managers. The system has been continuously customised generating also an IT provider lock-in. When managers' needs could not be satisfied through personalisation, additional packages characterised by technological heterogeneity, were introduced and connected to the legacy system. After the retirement of the IT manager, the IT department was re-organised. A new CIO was identified among the technical personnel of the department and a new organisation structure, with the CIO reporting to the CFO, was implemented. Different initiatives aimed at innovating the IS failed mainly due to the inability of the CIO to create a common language with business managers and to face the scepticism of the end users towards change. As the CIO recalled: *"We have launched and tested new applications in the CRM domain, but working with a CRM approach requires changes in the way we collect and manage data and in the relationship with our re-sellers. All the personnel involved expressed concern. They claimed they had already invested their time in previous initiatives that didn't work out"*. The CFO reported not to have understood the potential benefits of the IT projects proposed by the CIO and consequently reduced the IT budget over the years. The CFO commented on the IT budget: *"Every year we receive an IT budget for investments, that, at the end of the following year, is not confirmed by projects and initiatives. I concluded that forecasts are not reliable and that the company does not need new solutions"*. As a consequence, the IS progressively deviated from business needs. Bankruptcy of the IT provider who had implemented and was maintaining the customisations of the legacy system pushed the CIO to propose a revision of the IS. The transformation in the competitive environment, where promising markets were moving from Europe to Asia, created the fertile ground among business management to support the innovation initiative. The CEO stated: *"I'm not an expert in IT, and I never interfere in technological choices. I just have the feeling that we cannot proceed the same way we have done for the last 20 years. I keep on receiving complaints by our managers about their frustration for not being able to do what they want, due to the limitations of the IS"*.

Company 2 is leader in the national market, characterised by limited competition, and is experiencing a growth phase at international level and therefore a dynamic business pressure. President and CEO has always showed awareness of the potentiality of IT, but limited technological skills. IS has been managed for long time by one of the line managers with limited attention. As a consequence, the IS was not the result of a planned and guided process and, even though it was based on up-to date packages, it lacked the capacity to support key processes in an integrated form. Some inaccurate choices, including the introduction of new administrative and operations packages that didn't match business needs and were not integrated, contributed to generate in line managers a feeling of dissatisfaction with the contribution of IT to business value. The presence in the stock market pressed the company to cope with the need of data on several aspects of the business processes, that could not be provided by the IS. The selection of a new CIO, coming

from a consultancy background, promoted innovation in the IS and revision of the whole application portfolio. The CIO stated: *"I have just arrived. I was 'lucky' as the company realised that previous investment in new IS was a failure. Over 300.000 € were wasted in wrong investments and the management realised that an intervention in IT governance and structure was necessary to trigger change".* Despite scepticism about IT choices, the company's mentality, open to innovation and aware of the need to improve IS efficacy, supported the successful revision of the IS. The IT department was reinforced to support the evolution and management of the IS.

Narratives of the alignment evolution in the two cases differ in terms of degree of alignment achieved, actors who promoted and managed the evolution of the IS, efficacy of the projects undertaken, phases in the evolution of the alignment projects. However, in the cases it was possible to identify the key mechanisms determining alignment.

Mechanism (a). Business provides inputs to organization and activates changes. Business pressures may arise inside or outside the organisation. In company 1 the CEO, who is also responsible for sales, commented on the evolution strategy of the company: *"Our products are standard and do not embed unique, differential technologies. We compete on prices and time to delivery. We need to streamline the production, reducing time from order to delivery. If our re-sellers require a product and we cannot deliver it in one day, they contact another supplier. We must have the product ready when they ask for it".* Head of operations stated: *"The new [information] system will have to help us optimize scheduling. Production efficacy is paramount. The time required by my colleagues [of the operations department] to use the system to schedule production has to be at least as efficient as it is now".* In company 2, internal reports and official communications presented an evolution strategy at international level, that requires appropriate management tools. The CFO stated: *"We are listed in the stock market. As a consequence, we must comply with regulations and at present I'm concerned about the lack of information due to the fragmentation of our [IS] tools."* In both cases the competing environment and the context are perceived by the management as driving forces to promote change within the organisation.

Mechanisms (b) and (c). The analysis of how the company designed the new IS, launched IT projects (mechanism b) and faced change (mechanism c) exhibits a mutual influence between the organisation sub-system and the IT sub-system. In company 1, a consulting firm was involved to support the company in the transformation process. Consultants acted mainly as intermediary between business needs and IS design and as motivators for end users during the change phase. The involvement of external consultants marked a new approach in how the alignment process was managed and implemented in the company. The CIO stated, during the implementation of the new IS: *"Before starting this activity [the transformation of the IS], our approach to business needs was mainly reactive. We expected end users [line managers and employees] to provide inputs for new IT solutions ... in some cases they presented their needs and the solution they had already identified. Sometimes, company departments even purchased directly the new IT solutions and involved us [IT department] to integrate the solutions into the corporate IS".* A new IT governance model, based on periodical needs analysis performed by the IT department was proposed and tested. Survey on satisfaction of services provided by the IT department and of the new IS confirmed the perceived improvement in alignment. In company 2, the new CIO was specifically hired to manage the transformation of the IS to match business needs. He described the relationship with end users: *"My previous employer was a consulting firm [and ERP system integrator] and I'm used to operate in a logic of client-server with the end users of the IS. ... What was effective in both the needs analysis and in the support when employees had to cope with the new technology [the new IS] was the identification of key persons within each department, that I periodically invited to discuss the problems of the IS. They are my 'IT ambassadors' in the company".*

Mechanism (d). Alignment between organisation and IT sub-systems unlocks the possibility to transform business. According to Chan and Reich (2007), "depending on the model of alignment, it is necessary for IT to challenge the business, not simply implement its vision" (p. 298). Evidence from cases supports this claim. Impact on business can tackle the products, the services delivered to the market, or the internal business processes of the company. In Company 1 the availability of a software capable of managing customers' requests in a more effective form allowed the company to introduce a new post-sales service. A middle manager with previous experience in post-sales was hired for that. A new software product for post-sales activities was selected and integrated with the IS. Furthermore, the capability of collecting and managing customers' data triggered a redesign of the products. the opportunity for the design department

to re-design and innovate products, embedding sensors into devices with the aim of performing remote control and predictive maintenance. In company 2, the head of operations commented on the introduction of the IS: *"We are now revising our supply chain. We are evaluating new investments on production capacity and selecting suppliers that can participate to production in case of high production needs. We can do it now, simply because we have the data and we can perform operations analysis".*

Explanation of Alignment Based on Co-evolutionary Theory

Drawing on previous studies on complex systems (Alaa 2009; Alaa and Fitzgerald 2013; Allen and Varga 2006), we argue that alignment is a co-evolutionary process involving three sub-components of the organisation and four mechanisms. Mechanisms are influenced by three types of factors: dynamic actors, enablers, and control parameters. Dynamic actors represent the agents that realize alignment through actions on the IS, the organisation sub-system, and the business. The enablers comprise the properties or the pre-conditions that allow dynamic actors to operate and be effective in their transformation actions. The controlling parameters reinforce or reduce the effect of the action of dynamic actors and therefore moderate the alignment process. Although not mandatory for the efficacy of the alignment process, controlling parameters have a mitigation of reinforcing effect on alignment. Furthermore, data from narratives of how the alignment process was started showed that, in order to be initiated, alignment needs a triggering event or condition. The interpretation model of the interaction between the different factors that influence alignment is presented in Figure 2.
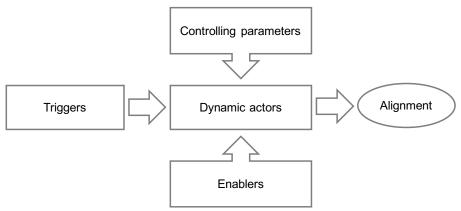

Figure 2. Types of Factors Influencing Alignment in a Complexity Perspective

The three types of factors have been identified and investigated through case studies. Parameters (pre-conditions, barriers, and inhibitors of alignment) present in the literature adopting a variance theory have been selected, classified into groups (Table 1), and considered as candidate factors for the case studies implementation and analysis. During the investigation of the mechanisms of alignment in the companies, we deepened the role and mutual influence of the factors.

Dynamic actors represent the active agents that implement changes in organisation and IS, leading ultimately to alignment. Since they actuate transformation, dynamic actors are related to persons within or outside the organisation. We identified three forms of dynamic actors: the committed top management, the IT champion, and the external ecosystem.

The *top management committed to change* implements alignment improvements through indirect actions. In both cases the top management, the CEO and sales manager in company 1 and president and CEO in company 2, played an active role in acknowledging the need of change and in identifying an external actor or a new CIO as actuators of change.

The *IT champion* is a profile, within the organisation, that combines business and IT competences. He is capable of capturing and understanding business needs and transforming them into IT requirements and ultimately into IT projects. Similarly, he is aware of the business implications of IT choices and act on the organisation sub-system. In company 2, the recently appointed CIO combines technical and business background. The IT champion holds some of the characteristics, such as combined knowledge of business

and IT domains, recognised IT leadership, communication skills, that are key determinants for alignment (Luftman et al. 1999; Preston and Karahanna 2009; Chan et al. 2006; Wagner et al. 2014) .

The *external ecosystem* comprises 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 organisation sub-systems. Company 1 did not comprise a leading IT and the alignment process was actuated through a consulting company. A representative of the consulting company stated: *"We are not technicians, we are just sensitive to needs and we know the potential of technology. … Maybe we were just in the right position, as an external actor, to be listened by the top management that trusted us and accepted to change their IT investment policy [prior to the alignment project, IT investments have been gradually reduced over the years]. We recognised that the existing IT department was excessively focused on operational and technical tasks and would have not been capable of capturing business needs effectively. We accepted to participate for two years to an initial needs assessment activity and to the following selection of the technology partner to design and implement the new IS".*

The first mechanism of alignment (a), the business influence on organisation, is implemented by the dynamic actors. A committed top management is not sufficient condition for change. In both cases analysed, top management exhibited commitment to change, but alignment process could not start until a second dynamic actor was introduced. Lack of the second dynamic actor impedes alignment to occur. During a telephone interview, 10 months after the end of the IS renovation project and the end of the collaboration with the consulting company and the technology partner, the CIO of company 1 confirmed: *"We are gradually going back to a situation of dissatisfaction of end users with IT and to unsupervised IT investments. Middle managers press to purchase new software independently from the IT department supervision".* The answer to the question on his role of business needs collector, performed during the IS project, was: *"It's not in our [of the IT department] DNA".* Removal of the external ecosystem was leading to the termination of the alignment process.

In order to be effective in this mechanism, the action of dynamic actors requires enabling conditions. Consistently with prior literature on alignment (Preston and Karahanna 2009; Chan et al. 2006; De Haes and Van Grembergen 2009). Two parameters classified as governance factors were identified in the cases: the CIO directly reporting to the CEO, in company 2, and the CIO participation to an executive committee and IT budget control and reporting, in company 1. Enabling conditions in company 1 were suggested by the external consultants during the new IS implementation project. After the end of the IS innovation project and the conclusion of the collaboration with the external consultants, the progressively dismantling of the governance practices was reported by the CIO, who didn't have a direct report to the CEO, as key obstacles in the prosecution of the activities of needs collection and analysis.

Shared domain knowledge was indicated as a controlling parameters in the two cases. The use of a similar, business oriented, language by the top management and the CIO was indicated by the CIO as a catalyser of alignment in company 2. Even during the phase of IS transformation, with dynamic actors and enablers in action, in company 1, the absence of a shared domain knowledge was reported as an element that slowed down the process of needs collection. *"Whenever I ask for something, the answer of the CIO is that we cannot do it and to explain the problems he [CIO] asks me a long list of technical questions I cannot answer to"* was reported by the CEO during one of the interviews. Consistently, the CIO reported of not being able to understand what was the final objective of some of the CEO's requests, that had to be checked and verified with the help of other managers of the company.

The second mechanism of alignment (b), the transformation of business needs into IT projects and their implementation, is performed by the IT champion (company 2) or the external ecosystem (company 1). Shared domain knowledge and technological properties of the IS, such as the modularity of the IS, the flexibility of the applications, and the novelty of the technology emerged as necessary pre-conditions to implement the project. The CIO in company 1 justified the inability to satisfy some of the top management requests, before the introduction of the new IS: *"Our current [in 2013] IS is based on a legacy technology. When we are asked to deliver a new application based on up to date technologies or integrate new application or devices with the legacy system, I have to explain that we need to involve the IT consultants and we have to customise the software. The change possibilities of our technology are not aligned with the flexibility managers and end users experience when using the Web or the smartphones ."* During the interviews with the CIO and the system architect in company 2, both informants indicated that, based on

previous experience, the modularity of the IS was a key requirement posed during the selection of the new IS for the company. The system architect, who has been working for the company for the last 10 years, added: *"When we introduced the previous IS [the IS that was subsequently integrated and partially replaced by a new IS], we selected a software simply by looking at our main competitor [that was operating in a different country]. We purchased the package and then we realised that it was not capable of supporting some of the peculiarities of our processes connected to our nationality [the software didn't support the specific administrative regulations of the country]. It didn't offer some of the functionalities that emerged as necessary in the operations department and the cost for extending the existing functionalities was excessively high. We therefore had to purchase a different package and the integration among the two applications was implemented through ad hoc developed software, as the first package was not modular, nor open".* The reported role of the infrastructure flexibility is consistent with studies on strategic and operational alignment (Chung et al. 2003; Overby et al. 2006) that identify the dimensions of flexibility, such as compatibility (i.e. the ability to share information across different technologies), connectivity (i.e. the ability of a technology component to communicate with any other components), modularity (i.e. the ability to easily reconfigure, add, modify, or remove, technology components), as necessary condition for transforming requirements into IT projects and for implementing them. In addition to flexibility, shared domain knowledge is reported as a pre-condition of alignment in several studies (Table 1). Misunderstanding between end users and IT department in both companies before the involvement of an external company or the identification of a new CIO emerged as barriers against change.

Several governance practices have been indicated as parameters streamlining alignment implementation by several authors (De Haes and Van Grembergen 2004 and 2009). Case studies confirmed the role of governance. A centralised IT budget was introduced in company 1 to prevent fragmentation of IT projects and guarantee control by the IT department and consistency with business objectives. Project portfolio management, IT budget control and reporting, and IT steering committee were adopted in both cases.

The third mechanism of alignment (c), the adjustment of the organisation, is also performed by the IT champion and/or the external ecosystem. Consistently with prior literature on agility (Byrd and Turner 2000; Chung et al. 2003), personnel flexibility was a necessary condition for the adaptation in both cases analysed. Flexibility was assessed as a combination of personal propensity to adapt to changes and variety of actual and potential skills that the personnel should possess to exploit change. In company 2, the CIO reported that *"the introduction of a new IS and the corresponding revision of working procedures found fertile ground due to the qualified skills of the personnel".* However, the presence of rigid procedures connected to the fact that the company was listed in the stock market posed many constraints. In company 1, the introduction of CRM functionalities didn't generate effect until a new profile with appropriate skills, in business analytics software and in sales, was moved to the sales department.

Prior IS success was indicated as a key controlling parameter. In company 1 the external consultant explicitly stated: *"When we started reviewing how personnel worked, in particular in administration and operations department, personnel recalled similar initiatives implemented in the past that didn't sort out the expected effect".* The CIO of company 2 described the implementation of the new IS: *"When we initially designed the implementation plan for the new IS that had to tackled different department, we immediately realised that the memory of the recent failure [the introduction of the previous IS] was a major concern for the employees. ...However, when the first users [line managers] of the new system in the operations department realised that they could schedule and monitor the production with the possibility to assess costs and therefore decide on strategies for investing in production capacity or adopting outsourcing strategies, they became much more keen to adapt their working procedures and they 'contaminated' the employees of the department. There was a sort of self-reinforcing mechanism".* Personal propensity to change and personnel flexibility benefit from prior IS success. Shared domain knowledge and company's culture were also key points mentioned by the companies as factors that in a positive or negative way influenced the acceptance of the changes.

The fourth mechanism of alignment (d), the transformation of company's business, is necessarily implemented by the committed top management. In both cases shared domain knowledge was a prerequisite for activating business change. The head of product design department in company 1, who has a strong technical and managerial experience, stated: *"We are now experiencing the potentiality of the business analytics tools we have introduced. We are now testing new smart devises [sensors and actuators] embedded into our products. Our vision is managing maintenance remotely and more*

effectively. If we monitor the performances of our products [heating and cooling systems], we can help customers save costs, which is a key driver to differentiate our offer." The evaluation on investments in new production plants or the implementation of an outsourcing strategy, mentioned by the CIO of company 2, and confirmed by the top management, was made possible by the capacity of the top (CEO) and middle (operations manager) management to understand the business potentiality and implications of IT.

Leadership of the top management in both cases was indicated by all informants as a key factor for influencing the efficacy of the transformation. In both cases companies were family managed, Presidents and CEOs belonged to the family that founded the company and had an authority and guidance capacity recognised by the employees. Leadership as a driving factors for IT-enabled change is recognised as a key driver in alignment as well in also strategic change literature (Pettigrew 1988; Hsiao and Ormerod 1998). Governance practices, such as the CIO reporting directly to the CEO in company 2, and the lack of confidence in IT by the CFO in company 1, were identified as potential controlling parameters. However, no common traits and limited evidence to support the identification of these factors as influencers of the efficacy of business transformation emerged from the cases.

Table 4.synthesizes the factors influencing alignment and their contribution to alignment mechanisms.

Alignment mechanism	Type of factors		
	Enablers	**Dynamic actors**	**Controlling parameters**
(a) Business influence on organization	Governance practices: - CIO reporting to CEO - Participation to executive committee)	- Committed top management - IT champion - External ecosystem	- Shared domain knowledge
(b) Transformation of business needs into IT projects and implementation	- Shared domain knowledge - Infrastructure flexibility (flexible application portfolio, modularity of the IS, updated technology	- IT champion - External ecosystem	Governance practices: - Centralised IT budget - Project portfolio management - Budget control and monitoring
(c) Adjustments in the organization	- Personnel flexibility - Absence of strict and rigid procedures	- IT champion - External ecosystem	- Prior IT/IS success - Shared domain knowledge - Culture
(d) Transformation of the business	- Shared domain knowledge	- Committed top management	- Leadership

Table 4. Factors and Mechanisms of Alignment

In addition to the types of factors identified in alignment literature and observed in the case studies, the assessment of the dynamics of alignment exhibited the mandatory presence of triggers, i.e. events or conditions that give rise to alignment processes. Despite the presence of dynamic actors and enablers, the transformation process towards alignment could not be initiated without triggers in the companies analysed. Company 1 experienced a continuous increase of misalignment until a key event, the bankruptcy of the IT provider, triggered change. In company 2, the presence in the stock market combined with the failure of an IT investment activated the transformation process.

Discussion and Conclusion

The objective of the study is to explain how alignment occurs in companies through the description of the mechanisms that govern alignment implementation, the identification of the factors that influence alignment and of their role in the process. Our results suggest that alignment is a co-evolution process

determined by four mechanisms: the business influence on organisation, the transformation of business needs into IT projects and implementation, the adjustment of the organisation, and the transformation of the business. Each mechanism is affected by three types of factors: dynamic actors, enablers, controlling parameters. The joint effect of the factors is responsible for the improvement or decline of alignment. While dynamic actors and enablers are mandatory conditions to initiate an alignment process, the controlling parameters act as moderators of the process. Furthermore, the alignment process requires triggers to be activated.

The study is positioned within the process perspective of alignment, i.e. the interpretation of alignment as a sequence of actions and adjustments, and exploits co-evolutionary theory to explain the interaction among the factors influencing alignment (Benbya and McKelvey 2006; Peppard and Campbell 2014; Vessey and Ward 2013; Merali 2006). It also capitalises on the results of researches adopting a state perspective of alignment that identify the variables contributing to alignment as antecedents, critical success factors, or inhibitors (Chan et al. 2006; De Haes and Van Grembergen 2009; Luftman et al. 1999; Preston and Karahanna 2009; Reich and Benbasat 2000).

Our research extends the extant literature in several respects. First, in the literature adopting the state interpretation of alignment key factors influencing alignment are identified and assessed. Factors are mainly studied as independent variables and a call for the exploration of the inter-relationship among them was proposed by authors adopting an alignment as a process perspective. "Rather than merely listing antecedents, we would encourage researchers to explore the inter-relationship among them" (Chan and Reich 2007, p. 311). Our findings classify the factors according to the role they have in the alignment process and identify some of the mutual influences, such as the relation between the committed top management and the other dynamic actors, the IT/IS history influencing the personnel flexibility. Second, the literature that adopts a process perspective of alignment describes it through the analysis of the actions and the domains that are affected or traces the evolution phases (evolutionary and revolutionary). Limited attention is dedicated to the investigation of how alignment is implemented. Drawing on a co-evolutionary interpretation of the company, we explain alignment as the outcome of a complex interplay of three sub-systems of the company and four mechanisms. The contribution of the factors to the mechanisms is assessed through the case study analysis, which represents a novel contribution of the study. Finally, the extant literature mainly focuses on the strategic dimension of alignment and addresses the other dimensions to a limited extent. In our study we adopted a holistic perspective of alignment, encompassing social, intellectual, and operational dimensions. Factors related to all dimensions are investigated and mutual interconnections described.

The implications of our study are both for theory and for practice. From a theoretical perspective we have provided insights into the process of alignment achievement. We recognise three key components of a theoretical contribution (Whetten 1989): *what* (i.e. the variables and mechanisms of alignment), *how* (i.e. the inter-relations existing among the variables and the mechanisms), and *why* (i.e. the causal justification of the relation among variable and mechanisms and among some of the variables). Our theory is explanatory (Gregor 2006) as it provides "explanations of how, why, and when things happen" (p619). The lack of a theoretical grounding of alignment is identified by several authors as a weakness in existing studies and pointed out as one of the motivations that inhibit alignment implementation in companies (Sabherwal and Kirs 1994; Maes et al. 2000; Luftman et al. 2017). Our interpretation of alignment mechanisms based on co-evolutionary theory opens new theoretical areas of investigations, in at least three directions. First, the identification of mechanisms and parameters can and needs be extended in order to provide a more extensive description of the alignment construct. Second, the mutual influence between the factors needs deeper analysis. In particular, an interpretation of alignment based on complexity science suggests that the mechanisms that govern the relationship between the components of the organisation and the mutual interaction between factors influencing alignment should be governed by feedback loops and non-linear links. These aspects have been addressed in our study to a limited extent. Third, researchers can exploit new methods of investigation derived from complexity theory to gain an in depth explanation of alignment. Quantitative methods such as system dynamics, non-linear modelling and analysis, and simulation can be proposed to this respect. Up to the knowledge of the authors, no studies have been yet carried out using quantitative methods to describe the dynamics of alignment in alignment and complexity science literature. From a practice perspective, the explanation of the mechanisms of alignment beyond a functional view of pre-conditions and inhibitors can be exploited by managers to select and introduce management practices that can effectively contribute to alignment achievement. Introduction of new profiles in the company,

revision of coordination mechanisms or communication channels, development of budget monitoring systems represent factors already indicated as positive contributors for alignment. The understanding of their role and contribution to the alignment implementation can influence the efficacy of managerial choices.

Several limitations can be identified in the study. Our research is based on two case studies, which necessarily provide a partial view of the reality. Despite the relevant number of informants interviewed and the volume of direct and indirect data collected, our database of information is limited compared to the number of parameters that influence alignment and that can be investigated. Therefore, not all the factors selected in the literature and not all their potential interactions were analysed or correspond to evidence in the cases. In the research design phase, we purposely selected companies exhibiting similar characteristics in terms of dynamicity of the competitive environment and role of IT in the company. Studies suggest that the external environment (Tallon and Pinsonneault 2011) and the connection between the business model of companies and IT (van Oosterhout et al. 2006) can influence alignment. Our design choice consequently restricts the applicability of our findings to other companies at general level. Finally, we selected co-evolutionary theory as founding theory for the investigation of the alignment mechanisms. We didn't investigate mechanisms and parameters based on competing theories that exist in alignment literature, such as resource-based theory (Peppard and Ward 2004; Reynolds and Yetton 2015) or dynamic competences (Baker et al. 2011; Hiekkanen et al 2013).

Future directions of research directly derive from the implications and limitations of the present study. Additional investigation is needed to validate and generalise our results. Extension of the perimeter of the cases, including for instance the relationship between alignment and the competitive environment and its connection with companies' business models, can help attain a richer perspective of alignment. The authors are currently involved in the adoption of quantitative investigation methods derived from complexity science, in particular non-linear modelling, for developing a deeper explanation of alignment implementation in companies and its dynamics evolution.

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