

A framework to analyse IS alignment approaches: Towards the definition of underlying alignment mechanisms

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Abstract. Today, companies are immersed in extremely competitive world-wide markets that change continuously. Thus, companies have to evolve introducing strategic and structural changes as a response to the external forces of the environment. This implies to consider the IS alignment from a global point of view integrating the classical “internal” strategic alignment with two other levels: the alignments with the environment and with uncertain evolutions. In this boarder, approaches that support and operationalise IS alignment are numerous but remain fuzzy towards the kind of alignment tackled. Therefore, it is proposed to build an analysis framework taking the global alignment problematic into account. It is composed of four elements and corresponding attributes detailing each aspect of alignment. This framework is applied to nine current alignment approaches in order to get a wide picture of the research in the domain. The corresponding analysis emphasises possible new work perspectives.

Keywords: IS alignment, alignment approach, information system, analysis framework

1 Introduction

Today, companies are immersed in extremely competitive world-wide markets that change continuously. In order to remain competitive and to survive, a company has to evolve introducing strategic and structural changes as a response to external forces. Such internal changes should impact, in most of cases, several levels of the organisation, namely, strategic, organisational, and information system (IS) levels. Corresponding dynamic adaptations of the IS are studied in the IS alignment field. The importance of IS alignment has been stated in several works such as [1] and [2].

Three levels of alignment are suggested by Camponovo et al. in [3] to enable a global and complete alignment of IS. The first alignment level corresponds to the nowadays “classical” -internal- alignment. It exists when the IS is in concordance with business organisation's goals and activities [4]. The second alignment level takes into consideration the external environment and assumes that the IS has to integrate features for assessing this environment. Finally, the third level copes with evolutions

over time and emphasizes the necessity to design IS able to evolve according to future changes in the organisation and its environment. Even though the internal level of alignment remains an essential and necessary first step in achieving alignment, the two others levels have progressively gained importance due to the increasing uncertainty and complexity of the external environment.

Several approaches have been proposed to support and operationalise IS alignment. Nevertheless, in these works there is no consensus about the terms used to denote each alignment level. Recurrent notions such as “IT/Business alignment” and “strategic alignment” can be found in the literature to indistinctly denote one alignment level and the three levels globally. This is harmful for the good understanding of the contributions and the target of those approaches. This understanding is crucial to analyse their usability and efficiency. Moreover, existing analysis of alignment approaches like [5] focus on the description of such works in order to work out the business/alignment requirements. In other words, there are no means to analyse and understand their underlying logic. The variety of the IS alignment approaches, their fuzziness in terms of target and used concepts show the need for such analysis means. These are essential to analyse the strengths and lacks of the existing and to propose ways to improve them.

Thus, this paper aims to explore some of the issues underlying IS alignment approaches and to propose a framework for their analysis through the characterization of their alignment mechanisms. Motivations for developing such a framework are twofold: (1) to identify the types of alignment addressed by them, and (2) to help to understand existing alignments approaches. The paper is organised in four sections. Section 2 gives a detailed description of the proposed framework. Section 3 applies the framework to nine IS alignment approaches. Section 4 analyses the results and draws conclusions and research perspectives.

2 An Analysis Framework to Analyse IS Alignment Approaches

IS Alignment is viewed in the literature as a conceptual bridge that links the IS domain to different viewpoints on other domains of an organisation and its environment. A first analysis of existing contributions, shows that those approaches are mainly composed of: (1) a set of layers representing organisational domains and (2) an alignment sequence to fit and link these organisational domains in an established order.

In other words, IS alignment deals with the two following questions:

- What domains should be align towards the IS domain?
- In what sequence align these domains?

In order to analyse IS alignment according the three levels proposed in [3], it is suggested to add the two following questions:

- Are there means to scan the environment ?
- Is the temporal dimension integrated ?

The first question is related to the alignment with the environment. To tackle this level two main activities are required: (1) Scanning the environment, (2) Defining supporting strategies. Therefore, the “environment scanning” ability of existing approaches has to be added. Moreover, once the environment has been scanned and the external forces understood, organisations can develop strategies in Business and IT domains as a response to maintain or change their position. In other words, this alignment level requires to integrate additional domains towards the domains “classically” implied in the strategic alignment. Indeed, alignment with the strategy, is traditionally performed by aligning the business strategy with the business processes, which are then in turn aligned with the IS. In this view the IT strategy is not considered. However, it has to be because this domain contributes to the alignment with the environment. Therefore, it is proposed to exploit and complete the concepts proposed in the SAM (Strategic Alignment Model) [6]. Indeed this model takes the IT strategy into account as a stand alone domain required to align IS, and in this sense tackles not only the strategic alignment of IS.

The second question is related to the alignment with uncertain evolutions. This alignment level requires a repeated alignment of the IS (with the strategy and with the environment) over the time. To perform this level the temporal dimension has to be integrated.

2.1 Structure of the Framework

To deal with these four questions defining the complete IS alignment problematic we propose to structure the framework as follows (cf. **Fig. 1**):

- To each question corresponds an analysis element in the framework. An element constitutes a particular aspect of the complete alignment problematic.
- To each element corresponds a set of attributes defining the underlying alignment mechanisms.
- To each attribute corresponds a limited set of values characterizing the defined alignment mechanisms in order to classify the analysed approaches.

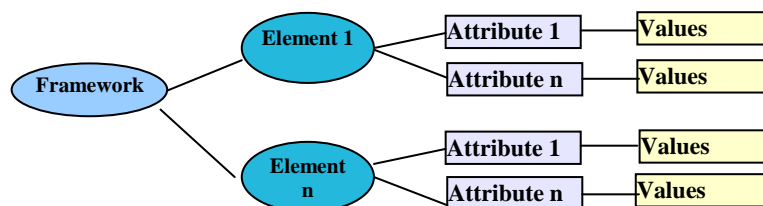


Fig. 1. Structure of the Framework.

The framework consists of the following elements (cf. **Table 1**):

- **The involved domains** corresponding to the question “What domains should be aligned towards the IS domain ?”
- **The alignment sequence** corresponding to the question “In what sequence align these domains?”.

- **The environment scanning** corresponding to the question “Are there means to scan the environment?”
- **The temporal dimension** corresponding to the question “Is the temporal dimension integrated?”

Table 1. Framework Overview.

<i>Element</i>	<i>Attribute</i>	<i>Values</i>
Involved domains	Involved domains	*Business strategy *Organisational infrastructure and processes *IT strategy *IT infrastructure and processes
Alignment sequence	Domain classification	*Anchor *Pivot *Impacted
	Type of relationships	*Strategic fit *Functional integration
	Alignment nature	*Planned *Emergent
Environment scanning	Environment scanning	*Yes *No
Temporal dimension	Temporal dimension	*Yes *No

2.2 “Involved Domains” Element

The involved domains element has just one attribute with the same name. The corresponding values stem from the Strategic Alignment Model (SAM) of Henderson and Venkatraman [6], which provides a complete and structured description of the domains and perspectives involved in the alignment. Indeed, the SAM draws a distinction between the external perspective of information technologies (IT strategy) and the internal focus of IT (IT infrastructure and process). It elevates IT strategy from the traditional role of IT as an internal support mechanism. In this sense it does not only tackle the strictly speaking alignment with strategy (linkage between the firm’s IS and business plans [7]) but integrates the domains required for the alignment with the environment.

According to the SAM two main domains are involved in the alignment: the business and the IT domains. These are split into two sub-domains through the external and the internal perspectives corresponding respectively to the strategy and the structure of each domain. Thus, the corresponding values in the framework are as follows:

- **Business strategy** at the external level of the business domain. It is structured by three components: business scope, business competencies and business governance.
- **Organisational infrastructure and processes** that form the internal level of the business area. This domain is composed of three components: administrative infrastructure, skills and business processes.
- **IT strategy** at the external level of the IT domain. It is structured by three components: technology scope, systemic competencies and IT governance.
- **IS infrastructure and processes** that form the internal level of the IT area. In the same way, it is formed by three components: IS architecture, IS skills and IS processes.

2.3 “Alignment Sequence” Element

The alignment sequence element describes and draws the sequence or path of alignment between the involved domains. Three attributes are proposed: (1) the domain classification corresponding to the position of the domain in the sequence, (2) the type of relationships between these domains and (3) the nature of the alignment sequence. These attributes can be described as follows:

- **Domain classification:** (values: *anchor, pivot and impacted*): this attribute aims at identifying the position of an involved domain in the sequence. In other words it emphasizes the direction of the alignment path. Indeed, according to [8] the involved domains can be classified as anchor domain, pivot domain and impacted domain. The direction of the alignment sequence runs from the anchor domain to the impacted domain, via the pivot domain. The anchor domain is represented by a square, the pivot domain by a circle and the impacted domain by the arrow's head (cf. Fig. 2).
- **Type of relationships:** (values: *strategic fit and functional integration*): this attribute describes the kind of relationship between the involved domains (cf. Fig. 2). According to the SAM [6], there are two kind of relationships between the involved domains: (1) Strategic fit describing the interrelationships between external and internal perspectives of a same domain (“business” or “IT” domain) and (2) Functional integration describing the link between “business” and “IT” domains for a same perspective.
- **Alignment nature:** (values: *planned / emergent*): this attribute focuses on the way of leading a given alignment sequence. According to [9], there are two modes of change that describe the role of the strategy through the process of alignment: planned and emergent modes. For the former, the alignment sequence is guided by the business strategy. On the other hand, in the later, the business strategy is shaped gradually through the process of change that makes alignment.

2.4 “Environment Scanning” and “Temporal Dimension” Elements

The two last elements of the framework “environment scanning” and “temporal dimension” have one attribute with the same name as the element. The corresponding

values are yes or no, indicating respectively if the environment is scanned or not and if the time perspective is integrated or not.

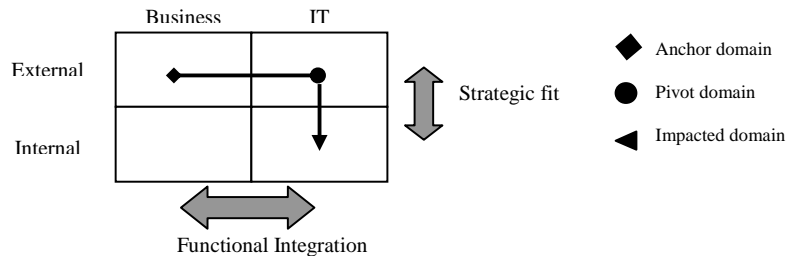


Fig. 2. Graphical Representation of the Framework

3 Analysis of IS Alignment Approaches

This section proposes an analysis of nine IS alignment approaches. The aim is, first of all, to get a “wide” picture of the research area of IS alignment. It is, secondly, to use the framework to analyse these approaches by identifying the levels of alignment addressed by them. For each work, the analysis is based on a mapping between the concepts proposed in the framework (elements and values of these elements) and the concepts proposed in each approach. Therefore, the analysis follows the same structure:

- *Identify involved domains*: this task consists in mapping the involved domains of the framework to these proposed in each approach. This is difficult because the domains of the approaches are often defined on a fuzzy manner and it is sometimes difficult to match perfectly the proposed domains to the framework involved domains. In this case, we choose to map the proposed domains to both involved domains of the framework. For example, in the BITAM approach [10], the term strategy covers the external business and IT domains of our framework.

- *Identify the alignment sequences*;
- *Identify the addressed alignment levels* (Environment scanning and Temporal dimension).

The following nine approaches have been analysed:

- BITAM (Business IT Alignment Method) [10]
- Fujisu (Australia) Framework [11]
- MIT90s Model [12]
- Longépé's approach [13]
- B-SCP [14]
- BALES [15]
- ARIS [16]
- Wieringa's approach [17]
- SEAM (Systemic Enterprise Architecture Methodology) [18].

The analysis results are synthesized in Table 2. This table is structured around four columns: the first gives the name of the approach, the second and the third detail the

alignment level, the last describes the involved domains and the corresponding alignment sequences.

In this paper it is proposed to detail the analysis of two approaches BITAM (Business IT Alignment Method) [10] and SEAM (Systemic Enterprise Architecture Methodology) [18]. First, it enables to illustrate how the analysis was performed. Secondly, it focuses on two approaches providing interesting elements towards performing a complete IS alignment. BITAM recommends the “misalignment” concept. SEAM recommends both “top-down” and “bottom-up” alignment sequences.

3.1 BITAM (Business IT Alignment Method)

BITAM (Business IT Alignment Method) [10] is a method that provides a set of twelve steps for managing, detecting and correcting misalignment. The methodology is an integration of two hitherto distinct analysis areas: business analysis and architecture analysis. The method invites different stakeholders, taking part in the project, to consider a range of re-alignment strategies. Then, it provides a process of decision to choose among possible alternatives. BITAM defines three layers of a business system:

- *Business model*: drivers, (business/IT) strategies, investments, revenue.
- *Business architecture*: applications, business processes, workflow, data flow
- *IT architecture*: hardware, software, networks, components, interfaces

Misalignments are defined as improper *mappings* between the layers. To manage these misalignments, BITAM proposes to manage continuously three alignments between the three layers:

1. *The business model to the business architecture*: it is ensured via the creation/exercising of operational scenarios which represent the business processes and practices that satisfy the business requirements and goals. These operational scenarios are mapped to the models of the current business architecture in order to detect and quantify misalignments.
2. *The business architecture to the IT architecture*: to deal with this alignment, the operational scenarios representing the business processes and practices are mapped to the current IT architecture in order to detect misalignments.
3. *The business model to the IT architecture*: it is ensured via the creation/exercising of IT change scenarios satisfying the business drivers. These change scenarios are mapped to the currently IT architecture in order to detect misalignments.

Once misalignments have been detected, alignment strategies are selected and adopted in order to restore coherence of the mappings. The analysis of the BITAM using the framework is as follows:

- *Identify involved domains*: in this task we place the BITAM domains into the involved domains of the framework. Sometimes it is difficult to match perfectly the proposed BITAM domains to the framework involved domains. For example BITAM Business models concern fuzzy notions such as business drivers, business/IT strategies, investments, etc. that may be placed in Business Strategy or IT Strategy

domains. In this case, we choose to mapping it to both involved domains. In the same way the other BITAM domains have been placed (c.f. table 2.)

- *Identifying the alignment sequences:* from the three alignments proposed in BITAM, the alignment sequences are analysed as follows:

- Domain classification: the change begins always at the business model (IT strategy and business strategy involved domains) which is the anchor domain. Business architecture and IT architecture are always the pivot or impacted domain.
- Type of relationship: this approach addresses the strategic fit in the business and IT involved domains (on one hand alignment between business model and business architecture for the business domains; on the other hand alignment between business model and business and IT architectures) as well as the functional integrations between IT and business at the internal level (business architecture to IT architecture) (c.f. table 2.)
- Alignment nature: planned. Indeed, the identified alignment sequences are guided by the IT and business strategies (c.f. table 2.)

- *Identifying the addressed alignment levels:* This approach considers the external environment at the business model layer. However evolutions over time are not explicitly supported.

3.2 SEAM (Systemic Enterprise Architecture Methodology)

Wegman in [18] considers the enterprise as a complex system that is continually in evolution. A SEAM enterprise architecture model evolves and can be adapted to represent changes of the environment. This enterprise architecture model is structured in organisational levels. An organisational level describes the enterprise from the viewpoint of one or more specialists.

SEAM considers four organisational levels:

- *The business level* represents the company and its partners in its market. It is generally used to understand the value created for the customer by the service or goods, and how revenue is made.

- *The company level* represents internal processes and interactions to achieve the strategic goals of the company.

- *The operation level* represents the people and systems composing the company (e.g. warehousing system or IT application). The operation level is generally analysed in terms of operating expenditure optimisation

- *The technology level* represents the technical infrastructure composing the systems (e.g. machinery in the warehouse or software components in the IT applications).

Each level describes either what currently exists (as-is) or what should exist (to-be) by using modelling techniques. This approach does not prioritise any of these levels to initiate or drive alignment. Moreover, no order of alignment is recommended. The iterative alignment process of the SEAM begins with the decision of an enterprise to

react to or to anticipate a change. The SEAM alignment iterations have 3 kinds of development activities:

- *Multi-level modelling*: the goal of this activity is to make a new model, or to modify an existing model of the organizational levels of the enterprise.
- *Multi-level design*: the goal of this activity is to identify gaps (between what currently exists (as-is) or what should exist (to-be)) and to resolve them. By doing so, new process and resources are defined to be developed and deployed.
- *Multi-level deployment*: the goal of this activity is to transform what is described in each organizational level to-be in artefacts that can be understood (by people or computers).

The analysis of the SEAM using the framework is as follows:

- *Identifying involved domains*: taking into consideration the description of the BITAM organisational levels, and matching their main characteristics with characteristics of the components of the analysis framework domains, we propose to map: (i) *the business level* to the business strategy domain; (ii) *the company level* to the organisational infrastructure and processes domain; (iii) *the technology level* to the IT infrastructure and processes domain. Mapping *the operation level* was quite complex because this organisational level concerns human resources aspects that may be placed at the organisational infrastructure and processes domain, as well as systemic and technological aspects that may be placed at the IT infrastructure and processes domain. In this case, we choose to map it to both involved domains of the framework (c.f. table 2.)

- *Identifying the alignment sequences*: the alignment sequences for the SEAM are analysed as follows:

- Domain classification: no order of alignment is recommended and change can start at any level. Therefore, any involved domain may become anchor, pivot or impacted domain.
- Type of relationship: The possible relationships that compose the possible alignment sequences are: strategic fit between the domains business strategy and organisational infrastructure and processes; and functional integration between the domains organisational infrastructure and processes, and IT infrastructure and processes.
- Alignment nature: planned or emerged. Indeed, the identified alignment sequences may be driven by any involved domain (c.f. table 2.)

Identify the addressed alignment levels: Although even as the IT strategy is not formally taken into account, SEAM considers the environment by modelling external actors, usages of products and services of the company, and market issues at the *business level*. These characteristics could be extended to consider the IT environment. The iterative method of SEAM enables to imagine future scenarios (to-be) for each organisational level and to reduce the gap between what currently exists (as-is) and these future scenarios (to-be). This gap is reduced by developing and deploying new resources in order to keep coherence between the organisational levels. It can be a means to align IS with evolutions of the strategy and environment.

Table 2. Analysis Synthesis

<i>Approach</i>	<i>Environ. Scanning</i>	<i>Temporal dimension</i>	<i>Involved domains and Alignment sequence</i>									
BITAM	Yes	No	<table border="1"> <thead> <tr> <th></th> <th>Business</th> <th>IT</th> </tr> </thead> <tbody> <tr> <td>External</td> <td>* Business models</td> <td>* Business models</td> </tr> <tr> <td>Internal</td> <td>* Business architecture</td> <td>* Business architecture * IT architecture</td> </tr> </tbody> </table> <p>Planned</p>		Business	IT	External	* Business models	* Business models	Internal	* Business architecture	* Business architecture * IT architecture
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Fujisu (Australia) Framework	Yes	No	<table border="1"> <thead> <tr> <th></th> <th>Business</th> <th>IT</th> </tr> </thead> <tbody> <tr> <td>External</td> <td>* Strategy</td> <td>* Strategy</td> </tr> <tr> <td>Internal</td> <td>* Roles and skills * Structure * Management processes</td> <td>* Technology</td> </tr> </tbody> </table> <p>Emerged</p>		Business	IT	External	* Strategy	* Strategy	Internal	* Roles and skills * Structure * Management processes	* Technology
	Business	IT										
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MIT90s Model	Yes	No	<table border="1"> <thead> <tr> <th></th> <th>Business</th> <th>IT</th> </tr> </thead> <tbody> <tr> <td>External</td> <td>* Strategy</td> <td>* Strategy</td> </tr> <tr> <td>Internal</td> <td>* Roles and skills * Structure * Management processes</td> <td>* Technology</td> </tr> </tbody> </table> <p>Planned</p>		Business	IT	External	* Strategy	* Strategy	Internal	* Roles and skills * Structure * Management processes	* Technology
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Longépé's approach	No	No	<table border="1"> <thead> <tr> <th></th> <th>Business</th> <th>IT</th> </tr> </thead> <tbody> <tr> <td>External</td> <td>* Business strategy (not proposed as a layer)</td> <td></td> </tr> <tr> <td>Internal</td> <td>* Business architecture * Functional architecture</td> <td>* Applicative architecture * Technical architecture</td> </tr> </tbody> </table> <p>Planned</p>		Business	IT	External	* Business strategy (not proposed as a layer)		Internal	* Business architecture * Functional architecture	* Applicative architecture * Technical architecture
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B-SCP	Yes	No	<table border="1"> <thead> <tr> <th></th> <th>Business</th> <th>IT</th> </tr> </thead> <tbody> <tr> <td>External</td> <td>* Strategic goals</td> <td></td> </tr> <tr> <td>Internal</td> <td>* Business processes</td> <td>* IS requirements and specifications</td> </tr> </tbody> </table> <p>Planned</p>		Business	IT	External	* Strategic goals		Internal	* Business processes	* IS requirements and specifications
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ARIS	No	No	<table border="1"> <thead> <tr> <th></th> <th>Business</th> <th>IT</th> </tr> </thead> <tbody> <tr> <td>External</td> <td></td> <td></td> </tr> <tr> <td>Internal</td> <td>* Process engineering * Process planning and control</td> <td>* Workflow Control * Application systems</td> </tr> </tbody> </table> <p>Planned</p>		Business	IT	External			Internal	* Process engineering * Process planning and control	* Workflow Control * Application systems
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<i>Approach</i>	<i>Environ. Scanning</i>	<i>Temporal dimension</i>	<i>Involved domains and Alignment sequence</i>																
Wieringa's approach	Yes	No	<div style="display: flex; align-items: center;"> <div style="margin-right: 10px;"> <p>External</p> <p>Internal</p> </div> <table border="1" style="border-collapse: collapse; text-align: center;"> <tr> <td colspan="2">Business</td> <td colspan="2">IT</td> </tr> <tr> <td>* Business environment</td> <td></td> <td></td> <td></td> </tr> <tr> <td>* Applications systems</td> <td>* Platform of implementation</td> <td>* Operation level</td> <td>* Technology level</td> </tr> <tr> <td>* Hardware/physical network</td> <td></td> <td></td> <td></td> </tr> </table> </div> <p>Planned</p>	Business		IT		* Business environment				* Applications systems	* Platform of implementation	* Operation level	* Technology level	* Hardware/physical network			
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SEAM	Yes	Yes	<div style="display: flex; align-items: center;"> <div style="margin-right: 10px;"> <p>External</p> <p>Internal</p> </div> <table border="1" style="border-collapse: collapse; text-align: center;"> <tr> <td colspan="2">Business</td> <td colspan="2">IT</td> </tr> <tr> <td>* Business level</td> <td></td> <td></td> <td></td> </tr> <tr> <td>* Company level</td> <td>* Operation level</td> <td>* Operation level</td> <td>* Technology level</td> </tr> <tr> <td>* Operation level</td> <td></td> <td></td> <td></td> </tr> </table> </div> <p>Planned or emergent</p>	Business		IT		* Business level				* Company level	* Operation level	* Operation level	* Technology level	* Operation level			
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4 Conclusion

This paper proposes a framework to analyse existing IS alignment approaches in order to evaluate their support to a complete IS alignment (alignments with the strategy, with the environment and with the uncertain evolutions). The structure of the framework is derived from four questions that define the complete IS alignment problematic. For each question an analysis element was determined. Attributes values for each element were specifically developed to describe the underlying alignment mechanisms and to identify the contributions of the analysed approaches in terms of alignment levels. Once the structure of the framework detailed, it was applied to nine approaches. The analysis performed highlights the following three conclusions:

- All the analysed approaches support the alignment with the strategy. Generally, this alignment is performed with the business strategy as anchor domain, the business processes as pivot domain and the IS infrastructure as impacted domain. Therefore, BITAM and SEAM are interesting because (1) the first proposes a double alignment path taking into account the IT strategy and (2) the later allows several alignment paths.
- Five approaches, namely, Fujisu Framework, MIT90s Model, B-SCP, Wieringa's approach and SEAM give means to scan the environment. This is a key factor for supporting alignment with the environment.
- The temporal dimension is seldom tackled only the SEAM integrates this dimension.

Concerning the underlying alignment mechanisms the following conclusions can be drawn. A planned alignment sequence begins always at the external domain level. In this case, the alignment sequence always consists in the composition of, at least, a strategic fit and a functional integration (in this order or in the opposite). An emerged alignment sequence begins always at the internal level. For both alignment sequence natures the impacted domain takes place at the internal level (generally the IS infrastructure). Last but not least the IS is considered as aligned if three of the four domains are implied in the sequence.

This analysis shows that the alignments with the environment and this with uncertain evolutions have become less attention. These levels should be tackled in future researches. Moreover, all possible paths have not been exploited.

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