UNDERSTANDING AND CLASSIFYING INFORMATION SYSTEM ALIGNMENT APPROACHES

OSCAR AVILA
INSA – Strasbourg
67084 Strasbourg Cedex France

VIRGINIE GOEPP
INSA – Strasbourg
67084 Strasbourg Cedex France

FRANÇOIS KIEFER
INSA – Strasbourg
67084 Strasbourg Cedex France

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 information system (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. Approaches that support and operationalise IS alignment are numerous but remain fuzzy towards the fullfilled alignment level. Therefore, it is proposed to build an analysis framework, based on theoretical alignment concepts, in order to analyse them towards this feature. It is composed of four elements and corresponding attributes detailing each level of alignment. This framework is applied to nine current alignment approaches in order to get a structured 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 [20], [8] and more recently in [14].

Three levels of alignment are suggested in [6] to enable a global and complete alignment of IS. The first alignment level, strategic alignment, corresponds to the nowadays "classical" — internal — alignment. It exists when the IS is in concordance with business organisation's goals and activities [17]. The second level, alignment with the environment, takes into consideration the external environment and assumes that the IS has to integrate features for assessing this environment. Finally, the third level, alignment with uncertain evolutions, copes with evolutions over time and emphasises 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 other levels have progressively gained importance due to the increasing uncertainty and complexity of the external environment. It is then crucial to tackle these three levels.

In this boarder, several approaches have been proposed to support IS alignment. So, we aim at (1) verifying that these existing alignment approaches address the three levels of alignment, (2) providing a structured picture of them. This would help (1) to choose the more adapted approach for a given context, in a modular and contingent logic; and (2) to outline the alignment levels that require additional research work.

Existing analysis of alignment approaches such as [11] only focus on the description of such works in order to elicit strategic alignment requirements. However, 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. The variety of the IS alignment approaches, their fuzziness in terms of target and used concepts hinder the achievement of our goals through a direct analysis of their natural language description. Indeed a higher abstraction level, enabling the formalisation of the approaches at the level of alignment concepts, is required to check completeness of alignment approaches. We propose to organize these alignment concepts according to the framework structure (elements, attributes and values) proposed in [22]. The instantiation of this structure to the IS alignment concepts is developed in section 2 of this paper. As a result a framework consisting in four elements and corresponding attributes and values detailing each alignment level is proposed This framework is a combination of a literature review on basic theoretical concepts of alignment and a coarse synthesis of alignment approaches. Alignment approaches provide raw material concerning the description of the underlying alignment mechanisms, that is to say, the way the alignment concepts are worked out in the approaches. Theoretical alignment concepts enable abstraction and formalisation of these mechanisms. Section 3 applies the framework to nine IS alignment approaches. These approaches are grouped by similarities in tackling strategic alignment. The framework is introduced prior to the alignment approaches because the description of the approaches without the framework would not be structured enough to reach our target. Section 4 analyses the results of the framework application in order to outline each alignment level. Section 5 draws conclusions and research perspectives.

2. A FRAMEWORK TO ANALYSE IS ALIGNMENT APPROACHES

Classically 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 preliminary coarse 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 these organisational domains toward each other in an established order.

In other words, IS alignment, and particularly alignment with the strategy, 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 two additional levels (alignment with the environment and aligment with uncertain evolution) proposed in [6], it is suggested to add the two following questions:

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

The first additional 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 integrating 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) [12]. Indeed this model takes the IT strategy into account as a standalone domain required to align IS, and in this sense tackles not only the strategic alignment of IS.

The second additional 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 the four questions defining the complete IS alignment problematic we propose to structure the framework as follows according to [22] (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.

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

- **The involved domains** corresponding to "What domains should be aligned towards the IS domain?"
- **The alignment sequence** corresponding to "In what sequence align these domains?".
- **The environment scanning** corresponding to "Are there means to scan the environment?"
- **The temporal dimension** corresponding to "Is the temporal dimension integrated?"

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 [12], which provides a complete and structured description of 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 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 [21]) 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:

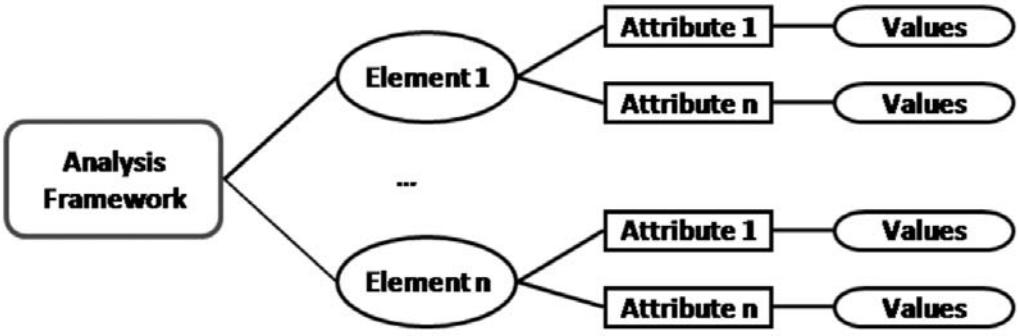


FIGURE 1. Structure of the Framework.

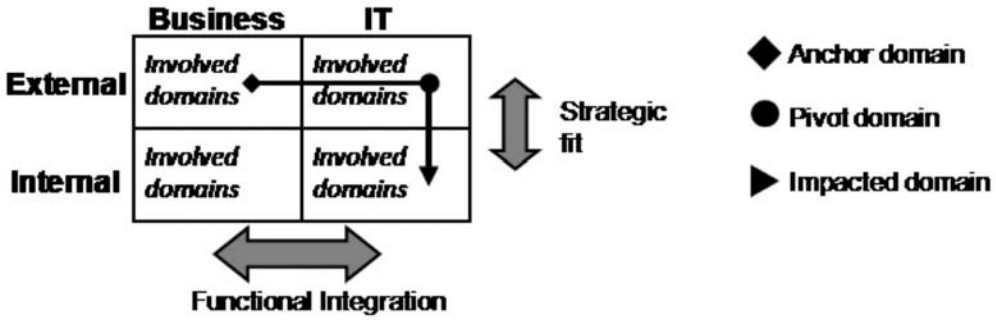


FIGURE 2. Graphical representation of the Framework

- **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. It emphasises the direction of the alignment path. According to [16] 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 [12], 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 and emergent): this attribute focuses on the way to lead a given alignment sequence. According to [13], there are two modes of change that describe the role of the strategy through the alignment process: planned and emergent. For the former, the alignment sequence is guided by the business strategy. In the later, the business strategy is shaped gradually through the process of change that makes alignment.

2.4. "Environment Scanning" element

Alignment between the organisation's strategy and its external environment is seen as essential for performance. The environment scanning element is closely linked to scanning the environment of an organisation which is defined as a search for information about the events and relationships in the external environment. The knowledge of this element can help the top management to plan the company's future course of action [1].

According to [6], there are three main perspectives to scan and assess the environment. It is proposed to use these perspectives as values for the **environment scanning** perspective attribute defining completely the corresponding element. The values are the following:

- *Actors*: It deals with complex networks of actors present in the external environment, that encompass a large number of interdependent organisations which are interrelated in an intricate way. Knowing the characteristics and capabilities of such actors could be crucial in order to determine, for instance, the type of governance mode for a possible partnership or alliance. Indeed, the empiric study led in [2], concerning 485 enterprise alliances in 6 Asian countries, shows how these features influence the type of alliance made between partners.
- *Uses*: The use or usage perspective represents the demand side of the organisation's environment
- *Issues*: It can be defined as open and debatable questions, events or other forthcoming developments whose realization can significantly influence the future conditions of the environment and, consequently, the ability of the organisation to achieve its objectives [3].

2.5. "Temporal Dimension" element

Evolutions in the environment or in the organisation's strategy would require IS to be repeatedly aligned. It emphasises the necessity to implement features in the IS to cope with potential evolutions over the time. This is particularly the case of companies immersed in uncertain and rapidly changing environments.

A preliminary analysis regarding the support to evolutions shows that:

(i) elements to address the current state (As-Is) of the IS are proposed by all the existing approaches;

(ii) elements to deal with emergent changes (Next Step) to be implemented in the IS are supported by most of the existing approaches. These works aim to make the IS reactive (for instance, through a modular design in order to rapidly respond to emergent requirements.)

However, a responsive design of IS is not enough to respond to long-term evolutions in business and technological environments. Dealing with these evolutions requires the ability to draw more detailed IT planning [18] and to imagine and elaborate future scenarios representing possible future states (To-Be) [9]. These scenarios provide means to design IS which consider technological and business evolution possibilities in advance and are thus likely to remain aligned for a longer time.

Moreover, the current state (As-Is) is a result of the evolution of a previous state (Past) [10]. Thus, former scenarios describing former states have to be also considered because they gave origin and constraint the current state (As-Is).

As a result, we suggest, for the last analysis element of the framework "temporal dimension", one attribute having the same name as the element, with the following values:

- *Past*: former scenarios describing a last state which gave origin and constraint the As-Is state.
- *As-Is + Next-Step*: describing, for the former; the current state, and, for the later; the emergent immediate requirements.
- *To-Be*: related to possible future states.

3. APPLICATION OF THE FRAMEWORK TO NINE IS ALIGNMENT APPROACHES

This section proposes a description of nine IS alignment approaches using the framework detailed previously. The aim is, to get a ''wide'' and structured picture of the research area of IS alignment. For each approach, the description 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 framework application follows the following structure:

- *Identifying involved domains*: this task consists in mapping the involved domains of the framework to these proposed in each approach. The original names of the domains of each approach are named on the graphical representation of the "involved domains" (cf. Fig 2).
- *Identifying the alignment sequences*: this task consists in describing the alignment path between the involved domains by using the three attributes: (i) *Domain classification* that describes the position of a domain; (ii) *Type of relationships* between these domains; (iii) *Nature alignment* that pinpoints the way in which is leading the alignment sequence. We use the graphical representation of the Framework (cf. Fig 2) in order to draw the alignment sequences of each approach.

TABLE 1. Framework Overview.

Element	*Attribute*	*Values*
Involved domains	Involved domains	* Business strategy * Organizational 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	Scanning perspective	* Actors * Uses * Issues
Temporal dimension	Temporal dimension	* Past * As-is+Next-Step *To-Be

• *Identifying the environment scanning perspectives;*

• *Identifying the integration of the temporal dimension*: this analysis element is not detailed for each approach. Indeed, all of them address the current state (As-Is) and the emergent changes (Next Step) to be implemented in the IS (As-Is+Next-Step value of the framework), the SEAM [25] additionaly enables to describe future states (To-Be value of the framework) for each organisational level. This description allows to reduce the gap between what currently exists (As-Is) and these future states (To-Be) by developing and deploying new resources in order to keep the alignment between the organisational levels. No approaches support the Past state (Past value of the framework).

In order to gain in clarity, the alignment approaches have been grouped in three sections by considering their similarities in the way to perform strategic alignment. Section 3.1 "Strategy Execution Paths" presents approaches that deal with the execution of the business strategy. Section 3.2 "Paths Linking Organisational and IT Infrastructures and Processes" presents approaches that address the functional integration between the "organisational infrastructure and processes" and the "IT infrastructure and processes." Section 3.3 "Alternative Alignment Paths" presents approaches that suggest several or alternative alignment paths.

3.1. Strategy Execution Paths

The approaches described in this section suggest the "classical" alignment path in which the business strategy is the anchor domain and drives both the design of the organisational infrastructure and processes and the design of the IT infrastructure and processes. The value of the analysis attribute "*alignment nature*" is "*planned*" for all the approaches in this section. Indeed, the identified alignment sequences are guided by the business strategy.

3.1.1. MIT90s Model

The MIT90s Programme was an important research effort designed to achieve conceptual integration between different organisation's change factors. From that research, Scott-Morton in [24] proposed the MIT90's Model, a framework for change management in organisations. This framework is based on the principle that success in the IT/business alignment is about achieving synergy and balance between six key factors:

• Environment.

• Strategy.

• Structure.

• Management processes.

• Technology.

• Individuals skills and roles.

The MIT90s model [24] identifies conceptual integration between the different change factors and demonstrates one 'classic' alignment path where the strategy is the driver of change. This path changes the organisation's structure which in turn leads to change in processes, technology and, at the end, individuals skills and roles.

∞ ***Identifying involved domains and the alignment sequences***: The "*Environment"* element makes visible the entities of the external environment and their relationships. It is needed for scanning the environment, so it is not placed on SAM components.

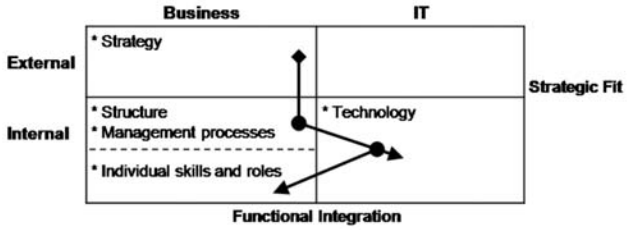


FIGURE 3. Graphical representation of the "involved domains" and "alignment sequences" for the MIT90s.

∞ ***Environment scanning:***

• *Scanning perspectives: actors, uses and issues*. Scott-Morton proposes in its framework the element *"Environment"* which rounds the other 5 elements of change. In this element external entities and factors in the environment (such as suppliers, customers, etc.) and their relationship are described. However concrete means are not proposed to describe them or model them (cf. Table 4).

3.1.2. Longépé's Approach

Longépé defines his approach as a mean for saving the consistency and improving the performance of the IS (i.e. the quality of its contribution to reach strategic goals) [15]. In this work four architecture levels are suggested to describe a business system:

• The business architecture.

• The functional architecture.

• The applicative architecture.

• The technical architecture.

This work suggests a top-down approach to define the alignment path between these four levels. Indeed alignment (i) starts from the business strategy, (ii) deduces for each strategic

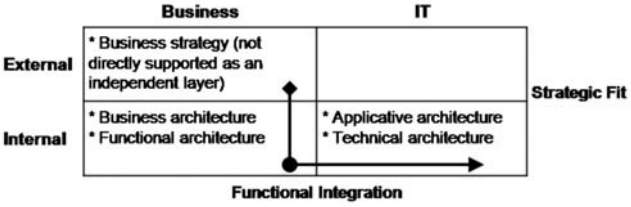


FIGURE 4. Graphical representation of the "involved domains" and "alignment sequences" for Longépés approach.

goal the business processes to achieve it, (iii) defines for each business process the corresponding business activities and (iv) IS functionalities and finally (v) describes the IS and technical components from IS functionalities.

∞ ***Identifying involved domains and alignment sequences (Figure 4).***

∞ ***Environment scanning:***

- *Scanning perspectives:* Uses. This approach describes the stakeholders implied in the alignment process. It also suggests a set of steps to carry out this process as well as to manage its main issues. The role of the different stakeholders through these steps is described and synthesised. This description could show the stakeholders' requirements associated to the use of the system. For instance, the definition of the role "accountant", by the description of its main functions, would give the basis to build the use case diagram of this specific type of user. Thus, this approach gives some elements for the "environment scanning" by the description of the uses of the IS.

3.1.3. B-SCP

Bleinstein et al. present B-SCP [5], a requirements engineering approach whose purpose is to enable validation of IS requirements in terms of alignment with context, business strategy, and the support business processes. Thus, B-SCP suggests the alignment of the next organisational elements:

- Context
- Business strategy
- Business processes
- IS description (grouping system context, system goals and functions and system processes)

For each element a specific analysis technique is used, Jackson context diagrams (part of Jackson problem diagrams) for context, i* goal modelling for strategy, and role activity diagrams (RADs) for processes. These three techniques are also used to respectively address the three elements (context, goals and functions and processes) composing the IS description. These are adapted and interconnected in order to form an integrated model. The analysis of the B-SCP approach using the framework is as follows:

∞ ***Identifying involved domains and alignment sequences (Figure 5).***

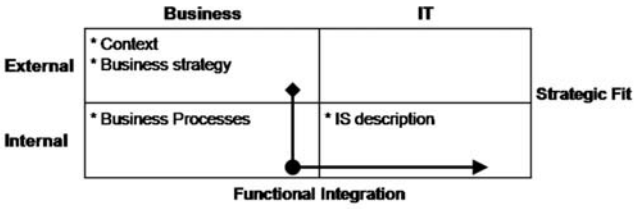


FIGURE 5. Graphical representation of the "involved domains" and "alignment sequences" for B-SCP.

∞ ***Environment scanning:***

- *Scanning perspectives: actors, uses and issues*. B-SCP uses Jackson context diagrams and Weill and Vitale's business approach as a mean of scoping the context of a problem, i.e. where the problem is located and what parts of the real world it concerns. The coupling of both techniques enables to tackle the "issues" scanning perspective by structuring the requirements as a goal model. Moreover, the Weill and Vitale approach structures the modelling around the *Domains of Interest* (suppliers, allies, customers and all the business model participants), and the *Shared Phenomena* representing the relationships between the domains of interest. Bleinstein et al. also suggest RADs, a notation used to describe business processes. This notation involves *interactions* among *roles* (humans as well as software and hardware systems). *Interactions* describe dependencies between roles in organizations, that work discretely and in union to achieve a goal. *Roles* and *Domains of Interest* cover thus the "actors" scanning perspective as well as *Interactions* and *Shared Phenomena* cover the "uses" scanning perspective of the analysis framework.

3.1.4. BALES (binding Business Applications to LEgacy Systems)

BALES (binding Business Applications to LEgacy Systems) [19] is a method to link enterprise models to existing wrapped legacy system modules or off-the-shelf components. It is based on an enterprise integrated framework for modelling business applications and for developing and delivering software solutions. This approach contains five layers of organisation's representation:

- Business goals and policies.
- Business objects.
- Business processes.
- Workflows.
- Enterprise IS.

BALES prescribes the following two steps approach to incorporate business change:

1. Adapt the existing enterprise model to reflect the new business reality.
2. Determine new mapping between the enterprise model and legacy systems.

∞ ***Identifying involved domains and alignment sequences (Figure 6).***

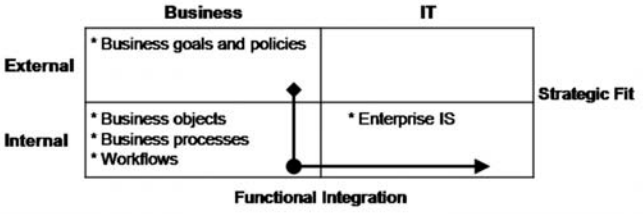


FIGURE 6. Graphical representation of the "involved domains" and "alignment sequences" for BALES.

∞ ***Environment scanning:***

- *Scanning perspectives*: No perspectives for scanning the environment are fulfilled.

3.2. Paths Linking Organisational and IT Infrastructures and Processes

The two approaches analysed in this section do not support the strategic vision, indeed they only address the design and development of the IS as a support of business processes and organisational infrastructure. For the two approaches in this section, we propose the value "planned" for the analysis attribute "*alignment nature*" because in both of these approaches the identified alignment sequences are driven in a top-down way by the organisational infrastructure and processes.

3.2.1. ARIS (Architecture of Integrated Information System)

Sheer and Nuttgens propose in [23] a general business process architecture termed ARIS (Architecture of Integrated Information System). ARIS combines two fundamental approaches for IS re-engineering: (i) the "technical driver" approach that is based on developing and implementing technical systems, and (ii) the "content driver" approach that is based on developing and implementing organisational systems. To achieve this combination in ARIS, Sheer and Nuttgens suggest four architectural levels:

- Level I — Process engineering
- Level II — Process planning and control
- Level III — Workflow Control
- Level IV — Application systems.

The four levels are interdependently connected, indeed ARIS prescribes a top-down approach for their alignment where the level I is linked to the level III because the development of workflow control systems requires the description of the business processes. At the same time, workflow control systems execute application systems (level IV) which are configured according to the business process models at level I. Workflow control reports actual data regarding the processes to be executed back to level II.

∞ ***Identifying involved domains and alignment sequences (Figure 7).***

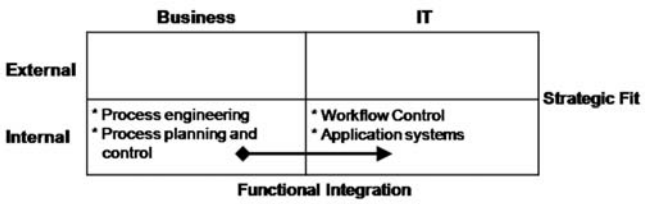


FIGURE 7. Graphical representation of the "involved domains" and "alignment sequences" for ARIS.

∞ ***Environment scanning:***

- *Scanning perspectives*: No perspectives for scanning the environment are fulfilled.

3.2.2. Wieringa's approach

Wieringa et al. [26] define an integrated and unified framework for business process and application architecture design, in which both the business and its application software are viewed as reactive systems, i.e. as systems that respond to events in their environment. This approach provides a classification of system properties or aspects highlighting the classic distinction between process on the one hand, and the product that results from this process on the other. The product may be an information system, a business, or any other information processing system. This approach takes into account three worlds, namely the physical, social and linguistic worlds for achieving alignment between business context and application architecture. These three worlds are structured in five layers of service provision (each of these layers is composed by entities having internal and external properties). The five layers are:

- Business environment
- Business processes
- Application systems
- Implementation platform
- Physical network.

Wieringa et al. suggest a top-down design approach for aligning the five layers. They use a number of interdependent architecture descriptions drawn from the higher layers to the lowers ones searching equivalence between elements composing the different descriptions, keeping thus coherence.

∞ ***Identifying involved domains and alignment sequences (Figure 8):*** the *"Business environment"* layer is about market segment, distributions channels, customers, suppliers, external events etc. This is needed to scan the environment, so it is not placed on SAM components.

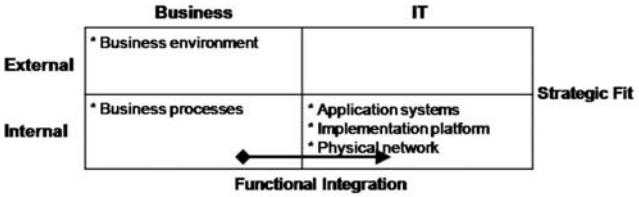


FIGURE 8. Graphical representation of the "involved domains" and "alignment sequences" for Wieringa's approach.

∞ ***Environment scanning:***

- *Scanning perspectives:* Actors and issues. This approach supports actors and issues perspectives through the definition of the *"Business environment"* layer. This layer addresses the description and representation of the external business environment by detailing external actors, the relationships between them, and the possible external events that may affect the organisation's performance. These elements of the business environment are described

by the creation of business context diagrams, textual descriptions, entity models and business event lists (cf. Table 4).

3.3. Alternative Alignment Paths

The approaches analysed in this section propose alternative paths to the classical "top-down" paths propose by other analysed approaches. These paths may have a "planned" or "emerged" alignment nature. We detail the "*alignment nature*" attribute for each alignment approach.

3.3.1. BITAM (Business IT Alignment Method)

BITAM (Business IT Alignment Method) [7] 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 to 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
- Business architecture
- IT architecture.

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*.
2. *The business architecture to the IT architecture.*
3. *The business model to the IT architecture.*

Once misalignments have been detected, alignment strategies are selected and adopted in order to restore coherence to the mappings.

∞ ***Identifying involved and alignment sequences (Figure 9).***

- *Alignment nature:* planned. Indeed, the identified alignment sequences are guided by the IT and business strategies.

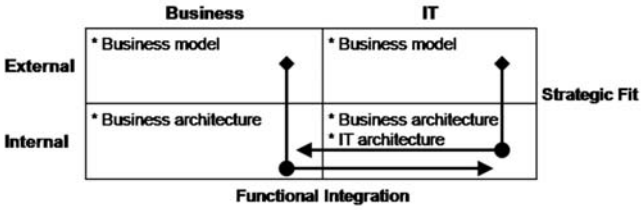


FIGURE 9. Graphical representation of the "involved domains" and "alignment sequences" for BITAM.

∞ ***Environment scanning:***

- *Scanning perspectives:* actors and issues. In order to formalise strategic goals at the business model level, organisation's managers have to scan and analyse the external environment. This environment analysis includes the identification of external entities (e.g. actors such as customers, competitors) and forces (e.g. issues such as new laws, technological partnerships) that may affect the organisation's position. To spread environment requirements to all the organisational levels, strategic goals are implemented by the stakeholders through the construction of operational scenarios and change scenarios (cf. Table 4.)

3.3.2. Fujitsu Framework

The Fujitsu framework [27] was build on the basis of the MIT90s model [24]. This approach is based on a technology-centred perspective that takes into consideration five elements of change:

- Strategy
- Structure
- Management processes
- Technology
- Individual skills and roles.

While Scott-Morton [24] suggests a classical alignment path where change starts at the strategy level, Yetton and al. in [27] demonstrate an alternative alignment path where IT is the driver of change. To illustrate it, they describe and analyse the case of Flower and Samios, a small firm of architects that transformed their business by adopting computer-aided design tools. Their path was to develop individual skills and roles, and then to change the structure and processes. The strategic vision evolved dynamically and grew out of the changes made.

∞ ***Identifying involved domains and alignment sequences (Figure 10).***

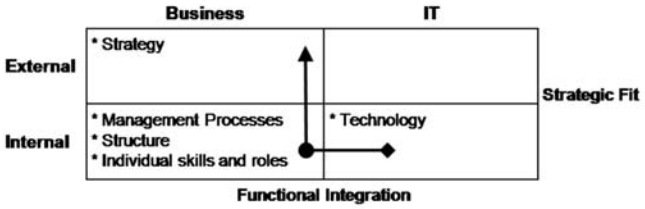


FIGURE 10. Graphical representation of the "involved domains" and "alignment sequences" for Fujitsu framework.

- *Alignment nature:* emerged. Indeed, the identified alignment sequences are guided by the *"Technology"* element.

∞ ***Environment scanning:***

- *Scanning perspectives*: No perspectives for scanning the environment are fulfilled.

3.3.3. SEAM (Systemic Enterprise Architecture Methodology)

Wegman in [25] proposes SEAM (Systemic Enterprise Architecture Methodology), an enterprise architecture methodology that considers the enterprise as a complex system that is continually in evolution. A SEAM model evolves and can be adapted to represent changes of the environment. SEAM represents the resources found in the enterprise and in its environment, together with the processes in which they participate. 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
- The company level
- The operation level
- The technology level.

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 three 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 organisational 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.
- *Multi-level deployment:* the goal of this activity is to transform what is described in each organisational (to-be) level in artefacts that can be understood.

∞ ***Identifying involved domains and alignment sequences (Figure 11).***

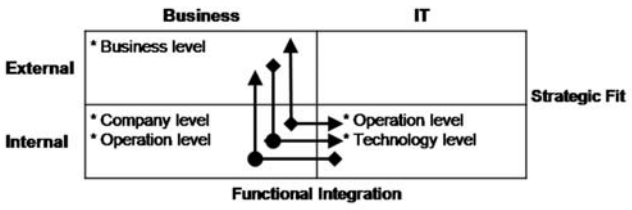


FIGURE 11. Graphical representation of the "involved domains" and "alignment sequences" for SEAM.

- *Alignment nature:* planned or emerged. Indeed, the identified alignment sequences may be driven by any involved domain.

∞ ***Environment scanning:***

- *Scanning perspectives*: actors and uses. SEAM integrates the environment by modelling at the *"business level"* the resources found in the enterprise an in its environment (external actors, usages of products and services) together with the processes in which they participate. This model represents only the entities of the company and of its environment that are relevant for the project. These characteristics could be extended to consider also resources and processes of the IT environment (cf. Table 4).

4. ANALYSIS OF THE REVIEWED IS ALIGNMENT APPROACHES

The four analysis elements structuring the framework enable to structure the description nine existing alignment approaches. It allows the understanding of the underlying logic of these approaches as well as the identification of the level of alignment addressed by them.

The framework application results are synthesized in Tables 2 to 5. Table 2 presents the results of the first analysis element "*involved domains"*. The reviewed alignment approaches are placed in columns and the SAM components in rows in order to map the layers proposed in each approach to the domains of the framework. In Table 3 the identified alignment sequences are described using the graphical representation of the framework (cf. Fig. 2). Table 4 summarises the third analysis element (identified scanning perspectives), and Table 5 presents the results of the fourth analysis element (temporal dimension).

In order to carry out the analysis concerning the level of alignment addressed, it is proposed to carry the three following complementary sub-analysis:

∞ First the analysis of Table 2 and Table 3 summarising the involved domains and the alignment sequences. Using these analysis elements, it is possible to detail if and how the alignment with the strategy is tackled.

∞ Secondly the analysis of the supported scanning perspectives (Table 4) coupled with the involved domains (Table 2). This enables to pinpoint the two key-factors of the alignment with the environment: (1) *Scanning the environment* related to the scanning perspectives and (2) *Defining supporting strategies* related to the involved domains.

∞ Finally the analysis of the temporal dimension (Table 5). This corresponds to our interpretation of the alignment with the uncertain evolutions.

4.1. 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. This level of alignment has thus a "planned" nature because change starts at the business strategy that in turn leads change to the other involved domains. All the analysed approaches support the alignment with the strategy except Wieringa's approach and ARIS which support it partially. Indeed both approaches search the alignment between the organisation's business processes and

the IS supporting them. Among the approaches addressing this level of alignment, the Fujitsu framework, BITAM and SEAM are interesting because (1) the first proposes an alternative path where the IS infrastructure and processes domain is the anchor domain, (2) the second suggests a double alignment path taking into account the IT strategy and (3) the later allows several alignment paths to perform strategic alignment.

4.2. Alignment with the environment

The two main activities to carry out this alignment level are analysed as follows:

(1) *Scanning the environment*: results of the analysis using the third framework element "environment scanning" show that only two approaches MIT90s Model (through the description of external entities and factors) and B-SCP (by modelling entities in the environment and their relationship using Weill and Vitale's notation) address the three perspectives, namely, actors, uses and issues, for scanning the environment. Three approaches support two scanning perspectives: Wieringa's approach and BITAM deal with actors and issues perspectives while SEAM supports actors and uses perspectives. Longépé's approach supports only the scanning perspective "uses". Regarding the techniques proposed to model the environment, B-SCP suggests the Weill and Vitale's notation, Wieringa et al. propose to describe it by the creation of business context diagrams, entity models and business event lists while SEAM supplies an original notation to model the environment at the business level. MIT90s Model and Logépé's approaches do not propose concrete techniques to model the environment.

(2) *Defining supporting strategies*: the analysis according the first framework element "involved domains" shows that only one approach, namely BITAM, supports the definition of both: business and IT strategies. All the approaches, except Wieringa's approach and ARIS, support only the definition of the business strategy. Regarding the techniques proposed to model the strategy they are various but commonly centered on goal modelling. Longépè's approach proposes to describe it by the creation of a goal model using Ishikawa diagrams and a company model using an ad-hoc notation. B-SCP suggests first to elicit the strategy using VMOST (an organizational alignment analysis technique) then to describe it using i* goal model. SEAM supplies an ontology (set of concepts and inter-relations) to model the different organizational levels. This ontology is based on RM-ODP, an ISO/ITU standard. BALES proposes an extended version of UML called BALES UML. This extension adds constructs such as <Business_Policy> that may support the description of the business governance component of the SAM. BITAM, MIT90s Model and Fujitsu approaches take into account the business strategy but do not propose concrete techniques to model it.

4.3. Alignment with uncertain evolutions

All the analysed approaches address the current state (As-Is) of the IS as well as the emergent changes (Next Step) to be implemented. This corresponds to a static vision of IS alignment that only considers the current state of the organisation and its IS, where possible long-term changes because of evolutions in business and IT environments are not integrated explicitly. This vision appears as relevant in a steady context but becomes limited in the actual context where uncertainty and continual evolution gains importance. Indeed, evolutions in the business environment such as new entrances or in the IT environment such as IT alliances may affect the current organisation's position. It is why a dynamic vision of IS alignment is required in order to be able to align continually the IS and in turn making it reactive, and even proactive to changes.

Only the SEAM iterative method enables to describe future states (To-Be) for each organisational level and to reduce the gap between what currently exists (As-Is) and these future states (To-Be). To support alignment with the evolutions using SEAM, it is necessary to describe, in scenarios, the possible changes that could take place at a given organisational level. Thus, the gap created may be reduced at the future by developing and deploying new resources in order to keep the alignment between the organisational levels.

TABLE 2. Mapping involved domains

Domain	Component	MIT90s	Longépé's Approach	B-SCP	BALES	ARIS	Wieringa's Approach	BITAM	Fujitsu Framework	SEAM
Business	Scope	X	X	X	X		X	X	X	X
	Competen.	X	X	X	X		X	X	X	X
	Governance	X	X	X	X		X	X	X	X
	Structure	X							X	X
	Processes	X	X	X	X	X	X	X	X	X
	Skills	X	X	X	X				X	X
IT	Scope							X		
	Competen.							X		
	Governance							X		
	Architecture	X	X	X	X	X	X	X	X	X
	Processes									
	Skills	X							X	X

TABLE 3. Alignment sequences

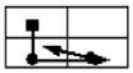
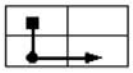
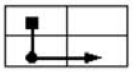
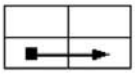
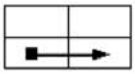
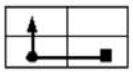
Strategy execution paths				Linking organisational and IT processes paths		Alternative alignment paths		
MIT90s	Longépé's Approach	B-SCP	BALES	ARIS	Wieringa's Approach	BITAM	Fujitsu Framework	SEAM
								

TABLE 4. Scanning perspectives

	MIT90s	Longépé's Approach	B-SCP	BALES	ARIS	Wieringa's Approach	BITAM	Fujitsu Framework	SEAM
Actors	X		X			X	X		X
Uses	X	X	X						X
Issues	X		X			X	X		

TABLE 5. Temporal dimension analysis

	MIT90s	Longépé's Approach	B-SCP	BALES	ARIS	Wieringa's Approach	BITAM	Fujisu Framework	SEAM
Past									
As-Is+Next step	X	X	X	X	X	X	X	X	X
To-Be									X

No approaches support the Past state explicitly. However, integrating this state in a more accurate manner than through the "classical" As-Is Analysis would enable to better grasp the existing situation and exploit it in order to gain from it in the future.

5. CONCLUSION

This paper proposes a framework to describe in a structured manner 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 a combination of theoretical concepts on alignment and a coarse synthesis of the alignment approaches. It is derived from four questions that define the complete IS alignment problematic and structured according elements, attributes and values [22]. For each question an analysis element was determined. Attributes and their values were specifically developed for each element in order to formalise the underlying alignment mechanisms and to identify the contributions of the reviewed approaches in terms of alignment levels. Once the structure of the framework detailed, it was applied to nine approaches.

Concerning the way the different alignment levels are tackled 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.

Moreover, the alignments with the environment and this with uncertain evolutions have become less attention. However these two kinds of alignment are today important for competitiveness and performance. For example, for improving existing and creating new competencies, it is not only to choose the better available IT in the market, but to better integrate and appropriate them to the function of the organisation [10]. Thus, to improve competitiveness it is essential to scan the environment using the *usages* perspectives, to gather user requirements, and thus, to develop and implement IS in coherence with these requirements.

These alignment levels should be tackled in future researches. For example, regarding the alignment with uncertain evolutions, the work should consist in replacing the current static vision (supported by almost all the approaches) by a dynamic vision in order to consider the temporal dimension. This new vision would allow to integrate in the IS design additional features enabling to consider, in advance, technological and business evolution possibilities and allowing thus a more robust alignment.

All possible alignment sequences have not been exploited.

Exploring them constitues an other research direction. Indeed, from all the possible logical alignment sequences converging towards the IS infrastructure, a classification may be carried out in order to differentiate:

1. The paths exploited in the literature.

2. The paths having no interest (e.g. impossible paths).

3. The paths which are potentially interesting but have not been still exploited in the literature.

Then based on this classification, the association between each segment of the potentially interesting sequences, and an operational tool or method could make the operationalisation of IS alignment possible. However, it is difficult to identify the potentially interesting paths among all the mathematical possibilities. A possible solution is to define rules such as those described in [4] to restraint the range of possibilities. For instance, the alignment sequences should imply always at least two relationships between the four domains: a *strategic fit* and a *functional integration*.

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