



Managing the alignment between business processes and software systems



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ABSTRACT

Context: The alignment degree existing between a business process and the supporting software systems strongly affects the performance of the business process execution. Methodologies and tools are needed for detecting the alignment level and keeping a business process aligned with the supporting software systems even when they evolve.

Objective: This paper aims to provide an adequate support for managing such a kind of alignment and suggesting evolution actions if misalignment is detected. It proposes an approach including modeling and measuring activities for evaluating the alignment level and suggesting evolution activities, if needed.

Method: The proposed approach is composed of three main phases. The first phase regards the modeling of business process and software systems supporting it by applying a modeling notation based on UML and adequately extended for representing business processes. The second phase concerns the evaluation of the alignment degree through the assessment of a set of metrics codifying the alignment concept. Finally, the last phase analyses the evaluation results for suggesting evolution activities if misalignment is detected.

Results: The paper analyses the application of the proposed approach to a case study regarding a working business process and related software system. The obtained results provided useful suggestion for evolving the supporting software system and improving the alignment level existing between them and the supported business process.

Conclusion: The approach contributes in all phases of the process and software system evolution, even if its improvement can be needed for identifying the impact of the changes. The proposed approach facilitates the understanding of business processes, software systems and related models. This favors the interaction of the software and business analysts, as it was possible to better formulate the interviews to be conducted with regard to the objectives and, thus, to collect the required data.

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1. Introduction

Issues regarding the alignment were mentioned for the first time in the late 1970s and, since then, studies and researches were conducted highlighting the alignment concerns [52]. In addition, researchers, practitioners and companies demonstrated through case studies, surveys and empirical approaches that the business and IT (Information Technology) performances are tightly coupled [7,12,18,23,25,31,33,46,54], and enterprises cannot be competitive if their business and IT strategies are not aligned. Indeed, high degree of alignment positively influences IT effectiveness and leads to higher business performance. Nevertheless, in the best of the authors' knowledge, industry has only marginally addressed these

aspects in a quantitative way, while the evaluation of the alignment represents a top concern issue.

In the literature, alignment is described at two different abstraction levels, i.e. strategic and functional [15,30], and it involves different concepts, such as enterprise goals, business entities, strategies and processes, technology, information system and data. In [3,4], the authors proposed a literature analysis highlighting that the large part of the proposed approaches are mainly focused on the modeling of business and software assets and few attention is paid to the evaluation of the alignment degree and identification of the evolution tasks to be performed for improving it. Actually, software engineers very often have to deal with cases in which misalignment occurs, and, as a consequence, a business process is not effectively supported by the used software systems. Misalignment may be due to a misuse of a software system or rapid changes of the operating environment [58]. It must be detected and evolution activities must be identified and executed.

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They can involve one or more entities of the analyzed business process, which are mainly activities and components of the supporting software systems. The authors performed a study pointing out that evolution activities are more effectively performed if the business process using a software system to be changed and the software system itself are known [6]. This requires the continuous monitoring of the existing alignment degree between business processes and software systems and involves measurement activities to be continuously executed in the operative business context, for catching possible misalignment and detecting the needed evolution activities.

This paper proposes an approach for managing, evaluating and maintaining the alignment between a business process and the supporting software systems at the functional level. The definition of alignment considered in this paper refers to the linking existing between business entities and software components. A business process is **functionally aligned** with a set of software systems if the measure of their alignment achieves an established threshold. Given the model of a business process and one representing the software systems supporting it, the measure of their alignment indicates at which extent each business entity (activity, artefact or operation) is supported by a set of software entities (software components), which have the same intended meaning. A more formal definition of the used concepts concerning the alignment is given in following section.

This paper introduces different and complementary aspects of the alignment concept, relying on: (i) the use of a modeling notation to represent the software systems and business processes; (ii) the definition of the types of links existing between these models; (iii) the quantitative analysis of the alignment relation; and (iv) the exploitation of the analysis results for identifying evolution changes. The approach the paper proposes is based on the coarse grained strategy proposed in [2], where the technological coverage and technological adequacy were first introduced. The paper improves the preliminary proposed solution by introducing a new set of metrics allowing the evaluation of different and complementary aspects of the alignment relationship. The new metrics consider both static and dynamic aspects of the modeled software and business entities and their reciprocal relationships. This paper also improves the used modeling notation, and includes additional concepts for better relating all the involved business entities.

The rest of the paper is organized as follows: [Section 2](#) discusses the analysis of the literature, outlines the motivations of the approach definition and provides the definition relating the considered alignment concepts; [Section 3](#) describes the proposed approach for the alignment evaluation and management; [Section 4](#) presents the software tool supporting the application of the approach; [Section 5](#) discusses a case study aiming at highlighting the applicability of the approach; and final remarks are given in the last section.

2. Literature review

A unique definition of the alignment does not exist in literature. Various alternative terms are used for referring to it [17]: fit in [19,30]; bridge in [22]; integration in [30]; harmony in [39]; linkage in [48]; fusion in [53]; and further definition and terms are in [17].

The literature regarding the alignment topic differs in the abstraction level and treated aspects it considers [58,59]. A study of the literature allowed to classify the papers addressing alignment in two main groups regarding *strategic alignment* and *functional alignment*. Strategic alignment of IT exists when goals, processes and activities of a business organization are in harmony with the information systems supporting them [41]. The functional level

regards the alignment existing between business processes and software systems and aims at optimizing the effectiveness of the software support during the business process execution.

The next section describes the analyzed papers, while the subsequent one discusses preliminary results of a performed quantitative review, and provides the definition of alignment considered in the proposed approach, and additional needed definitions.

2.1. Alignment studies

The literature analysis regarding the alignment is described in the following two subsections. The first subsection concerns strategic alignment, while the second one regards functional alignment.

2.1.1. Strategic alignment

In [45], the information technology alignment requires the definition of a planning process, helping to identify IT strategies, IT projects and Information Systems from the requirements of each business unit and to create links between the strategic and operational levels. In [50,51], a view of business and technological alignment is defined considering at which extent the business mission, objectives, and plans are supported by information technology mission, objectives, and plans. Concepts of “fit” and “integration” among business strategy, IT strategy, business infrastructure, and IT infrastructure are discussed in [30,44].

The Business and Information Systems MisAlignment Model – BISMAM – is proposed in [16,57], to understand, classify and manage misalignments in medical science context and uses a metaphor between misalignment and disease. In particular, the BISMAM modeling approach establishes a misalignment classification scheme that links enterprise architecture views, misalignment symptoms and causes, and defines techniques to detect, correct and prevent misalignments.

The association between strategic alignment, management of ERP projects, business process changes and business performance of ERP systems is analyzed in [60]. The results showed that the more the ERP system strategy is aligned with the business strategy, the more likely the ERP project is completed on budget and on time.

The IT requirement analysis can also impact the organization alignment level. In [13], a requirement engineering framework is presented that enables verification and validation of requirements in terms of alignment with the support of business strategies. In [42], business process models, normally used during the first stages of software requirements gathering, are considered as a valuable source for performing functional size measurement. SEAM – systemic enterprise architecture methodology – is a family of methods for strategic thinking, business/IT alignment, and requirement engineering [61,62]. In particular, SEAM for business is a method designed for analyzing the competitive environment of an organization, including its relationships with its customers, partners, and market regulators. SEAM also regards the alignment between enterprise environment and marketplace. The marketplace is also considered in [35], where the authors describe a multi-perspective framework and tool for supporting business IT alignment in a scenario of software service providers (e.g., ASP's or web service yellow pages). The approach considers all the relevant dimensions for the sourcing choice, that is services available in the marketplace that are aligned with the organizational goals.

The platform S2AEA (strategic alignment assessment based on enterprise architecture) is presented in [26] for modeling enterprise architecture and assessing strategic alignment based on internal enterprise architecture metrics, such as the degree of consistency between business strategies and information systems. In [20], the dynamic capabilities perspective is applied to analyze the

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