Business and Information Systems MisAlignment Model (BISMAM): an Holistic Model Leveraged on Misalignment and Medical Sciences Approaches

Gonçalo Carvalho[1], Pedro Sousa[2]

[1] KPMG Advisory, Avenida Praia da Vitória 71A - 11º, 1069-006 Lisboa
[2] Organizational Engineering Center, INESC, Rua Alves Redol 9, 1000-029 Lisboa
gcarvalho@kpmg.com, pedro.sousa@link.pt

Abstract. Organizations aim to achieve business and information systems alignment, but actually "feel" and "suffer", on a daily basis, the difficulties that inhibits the alignment achievement, in other words, the misalignments. This paper proposes a model, the Business and Information Systems MisAlignment Model (BISMAM), to understand, to classify and to manage misalignments. This proposal addresses the alignment problem combining misalignment approach with medical sciences approach based on a metaphor between misalignment and disease. The authors believe that the misalignment approach is closer to organizations real life and that medical sciences approach provides the relevant concepts and techniques for misalignment classification and management. Based on both academic research and years of professional consultancy, the authors propose an initial and possible instantiation to the BISMAM model, establishing a misalignment classification scheme that links enterprise architecture views, misalignment symptoms and causes, and defining techniques to detect, correct and prevent misalignments.

Keywords: Alignment, Misalignment, Enterprise Architecture, Medical Sciences.

1 Introduction

Align business and information systems is a critical concern to organizations, as it directly affects the organization's agility and flexibility [1], costs and efficiency [2], effectiveness and performance [3].

The issue of alignment was mentioned for the first time in the late 1970s and since then several studies and researches were conducted highlighting the alignment concern [4]. The Society for Information Management (SIM) published the key issues for IT executives, for almost a quarter of a century, reporting the alignment in the Top-10 of IT Management issues from 1980 through 1994 and as first or second major concern since 1994 [5]. The Computer Science Corporation (CSC) confirmed and reinforced these results in the Critical Issues of Information Systems Management (CIISM) survey, reporting that the alignment of information systems with business represents 54.2% of the IS managers concerns and is the second factor that most contributes to the IS success in the organization [6]. So, almost three decades after the

fist glance over alignment, the relevancy and actuality of this topic is unquestionable and remains as important and critical as ever [4][7]. SIM confirmed these results in its 2006 survey reporting that alignment remains the top concern for IT executives [8].

Understanding what business and information systems alignment is, how to obtain it and therefore maintain it, is a "problem" [7]. Traditional approaches addresses the alignment concern seeking an answer to how can organizations achieve alignment, but with little contribution on how to identify and correct misalignments. This research addresses the alignment problem, combining misalignment and medical sciences approaches. On the one hand, arguing that alignment is an intentional state that organizations aim to, and that misalignments are the factors that organizations as a whole and its organizational actor as enablers face in their routine business operations, the authors propose an approach focused on the study of misalignments. On the other, observing organizations as complex systems and based on an analogy between misalignment and disease, the authors propose to use medical sciences approach which provides an interesting foundation to set the misalignment nomenclature, to define the basis for a misalignment classification schema and to establish the core techniques for misalignment detection, correction and prevention.

This paper is structured as follows: sections 2 describes the most relevant misalignment approaches; section 3 describes the medical sciences approach, concepts and techniques related with disease; section 4 explains the reasons to adopt a combined approach based on misalignment and medical sciences; section 5 presents the Business and Information Systems Misalignment Model proposal; section 6 presents a simple example and possible instantiation for this proposal; and finally section 7 concludes this paper with a summary of main conclusions and contributions.

2 Misalignment Approach Overview

The misalignment concept has been mentioned within the scope of different alignment researches [9], especially when addressing the justification for alignment or when mentioning the impact to organizations that do not achieve alignment. However it was only recently that some authors focused on the misalignment study to address the alignment problem.

The first explicit focus on misalignment research was sponsored by Jerry Luftman [10], when proposed to identify a set of symptoms of misalignment that organizations could suffer, symptoms that, when experienced, indicate that an organization is not optimized, not achieving all potential. Although this approach does not provide an explicit definition for the concept, it foresees two relevant intentions: (i) misalignments might be expressed by symptoms, and (ii) misalignments inhibit organizations to be optimized and achieve full potential.

Following an evolution similar to the one that happened with alignment, a misalignment conceptualization was proposed at a more structured level with the Business and IT Alignment Model (BITAM) research project [11]. It is supported on a three-level model that defines the Business Model, Business Architecture and IT Architecture where misalignments are the improper mappings between the layers, and realignment initiatives are the activities that restore coherence to the mappings [12].

Within this approach, BITAM suggests that there are three stages of maturity in an organization's ability to deal with misalignment, in increasing level of maturity [12]: (i) Detection, (ii) Correction, and (iii) Prevention. According to this proposal, each stage is built based on the previous one, which means that to be able to correct a misalignment it must be able to detect it, and to be able to prevent misalignment it must be able to continuously perform detection and correction activities [12].

3 Medical Sciences Approach Overview

Medical Science is one of the most ancient sciences with centuries of evolution in the study of a very complex system, the human body, and in the definition of common nomenclature and techniques that are used worldwide. Within the scope of this nomenclature, one key concept is that of disease [13]. Disease means a deviation, an abnormal condition of an organism that impairs bodily functions, characterized by symptoms and signs [13][14][15].

The need for controlled medical vocabularies to classify disease into general groups and for detailed nomenclatures has been a hot topic over the centuries through the development of new and enhanced disease classification systems [13]. The Systematized Nomenclature of Medicine and the International Classification of Diseases are the most recognized disease classification system used by medical communities [13]. The approaches and focus on the classification systems have been evolving over the years, while the first efforts grouped diseases by their symptoms, modern systems focus on grouping diseases according to anatomy and causes. The classification of diseases is addressed by a specific discipline, the nosology, which deals with the systematic classification of diseases and the naming of clinical concepts characterized by a disease. According to this discipline, diseases can be classified by symptom, etiology, pathogenesis and by organ systems [16][17][18].

An organ is a relatively independent part of the body that carries out one or more special functions, e.g. the lungs, the heart. A group of related organs is an organ system, e.g. the respiratory system, the circulatory system. The organs within a system may relate in a number of ways, but functional relationships are most the commonly used [15].

A symptom is a sensation or change in health function experienced by a patient, such as headache, fatigue, tiredness, pain, or nausea. Symptom is therefore a subjective report or subjective evidence of disease, as opposed to a sign, which is objective evidence of the presence of disease or disorder. So, signs are observable whereas symptoms are not [19]. For example, a patient may describe visible sores or invisible pain, which means that the visible complaints are signs (that can be measured) while the invisible ones are symptoms (that cannot be seen or measured).

Etiology is defined as the study of disease causes or the study of agents that cause disease, e.g. the etiology for some lip cancers is overexposure to sunlight, which means that sunlight is an etiologic agent of these cancers [19]. However, the etiology is not always known and sometimes the answers to the cause and the causing agent might not be straightforward. Green proposed the "three C's of etiology", Cause,

Contribute and Correlate, and explains that each term refers to factors that may have something to do with the appearance of the condition [20].

Disease is a real life fact with strong impact on society. Medical sciences provide techniques to deal with and manage diseases: diagnosis, therapy and prophylaxis.

Diagnosis (diagnostics) is the process of identifying a medical condition or disease by its signs, symptoms, and from the results of various diagnostic procedures. It is an act of discrimination and characterization. The diagnosis process begins with a description of symptoms, and then the doctor obtains further information from the patient himself about their symptoms, his previous state of health, living conditions, and other environmental and social conditions. Additionally, doctor conducts a physical examination to gather disease signs [14][15][19].

Therapy (or treatment) is the attempted remediation of a health problem. A treatment should not be undertaken until the nature of a patient's illness is known and it should be rational, based on scientific facts and planned carefully [19]. A treatment can be complex as it may require several procedures to be undertaken and different specialists involved [15][19].

Prophylaxis is any procedure whose purpose is to prevent, rather than treat or cure, disease. These may include technical procedures such as vaccination and antibiotics, but also simpler initiatives such as daily physical exercise. There are two groups of prophylactic measures, the primary prophylaxis whose objective is to prevent the initial development of a disease, and the secondary prophylaxis used to prevent the further development of an existing disease [15].

4 Misalignment and Medical Sciences: A Combined Approach

This section explains the connection between the business and information systems misalignment and the medical sciences, and justifies the decision for this combined approach, based on the analysis of similarities and analogy relevance between the two approaches and supported by other authors' arguments.

Even though that providing a definition for alignment and misalignment is not straightforward, it seems that, on the one hand, alignment is perceived as a desired goal or state to achieve [21] and, on the other, misalignment is the opposition or the denial of alignment [9]. This is actually a similar approach, known as naturalist or descriptivist, to the one that was proposed in the context of defining health, suggesting that defining disease is a legitimate approach to the dual problem of defining health and disease [22]. Therefore, through a similar rational, misalignment might be a legitimate approach to the dual problem of alignment and misalignment definition. In fact, [23] argues that there are three key issues that support the alignment, one of them being the evidences of misalignment (the other two are the alignment's heuristics and the questions to specific roles whose answers reveal the nature and status of alignment). Currently, the only research that explicitly addresses evidences of misalignment is the one from Luftman [10] that proposed a list of misalignment symptoms, however at high level, which derives from the fact his work is based on the Strategic Alignment Model [24].

The relation between the alignment concern and the medical sciences was addressed for the first time by [25], arguing that three types of pathological issues can be identified within the alignment concern, and one of those issues is the misalignment. Since pathology is about diseases (the prefix "path" means disease and the suffix "ology" means the study [19]), an analogy between diseases and misalignment might be established and therefore, medical sciences concepts and techniques might be relevant.

In fact, medical sciences deal with a complex system, the human body, to which the initial knowledge was very limited. This is actually similar to the misalignment study on organizations. Organization is a complex system [26] and despite the achieved progresses in the recent years, it still with limited knowledge about themselves, at least the explicit knowledge. The implicit knowledge on organizations is even more important when the explicit knowledge is limited. The implicit knowledge is spread over all the organization and all the persons involved with the organization in the different contexts [27]. These persons are the ones that "feel" the misalignments and therefore this implicit knowledge is relevant to identify and classify the misalignments. However, since people use different syntactic to same intended semantic, it is required a common nomenclature and classification scheme. Medical sciences also recognized this requirement several years ago and efforts were developed throughout to establish concepts and disease classification criteria, which might be a contribution for misalignment nomenclature and classification.

As mentioned before, organizations want to achieve alignment [21] and misalignment is the opposition or the denial of alignment [9], which means that misalignment is a non-desired state or condition and therefore organizations should be able to detect, correct and prevent it. This is, according to [12], the three stages of maturity in an organization's ability to deal with misalignment. In fact, these three techniques are commonly used in several disciplines to deal with undesired conditions. Under medical sciences, diseases must be diagnosed, treatment plans must be prescribed and preventive medicine promoted, in other words, supports detection, correction and prevention techniques.

Based on these arguments, we conclude that, on the one hand, misalignment is not only a legitimate but a required approach to address business and information systems alignment and, on the other, because the metaphor and analogy between misalignment and disease is understandable and the study of disease helpful, the medical sciences is a relevant approach providing the foundation for misalignment nomenclature, classification scheme and management techniques

5 Business and Information Systems Misalignment Model

This section presents the Business and Information Systems Misalignment Model (BISMAM), an approach based on the study of misalignments grounded on the medical sciences perspective. The BISMAM model is structured in three main components: (i) Nomenclature, (ii) Classification and (iii) Management.

5.1 Business and Information Systems Misalignment Nomenclature

As mentioned before, the medical sciences concepts provide an interesting foundation to set the misalignment nomenclature. This section revisits those concepts, proposing adapted definitions to the misalignment context [35]. The following table presents the misalignment nomenclature and semantic in three groups, i.e. the misalignment concept itself, the relevant concepts for misalignment classification and the concepts that support the management of misalignments:

Table 1. Misalignment Concepts and Semantic

	Concept	Definition
	Misalignment	An abnormal condition that impairs organization components (architectures), characterized by typical symptoms and signs experienced by the organizational actors.
Classification	Organ System	The organization components, in other words, the architectures involved in the misalignment.
Classification	Symptom	Subjective evidence of misalignment that is experienced by organizational actors.
Classification	Sign	Objective evidence of misalignment experienced by the organization and observable both to internal and external organizational actors.
Classification	Syndrome	Set of symptoms and signs that typically occur together.
Classification	Etiology	The underlying factors that cause misalignment.
Management	Diagnosis	Process of identifying a misalignment by its signs, symptoms, and from the results of procedures, such as questionnaire and tests.
Management	Therapy	Actions whose purpose is to attempt to correct the misalignments identified by the symptoms/signs and confirmed through the diagnosis.
Management	Prophylaxis	Principles, guidelines and common sense rules whose purpose is to prevent, rather than treat, the misalignment.

Within this concept adaptation, two remarks are relevant: (i) while the medical science studies the human body complex system, this model focuses the study on organization, another complex system, and whereas the human body requires that a number of organ systems must function together, the organization can be observed by their enterprise architecture components (architectures) that must fit and function together; (ii) the pathogenesis concept relates with very technical medical aspects of disease thus, for now, it is not considered in the concepts analogy.

5.2 Business and Information Systems Misalignment Classification

Grounded on the medical sciences perspective, more specifically the nosology discipline, i.e. the branch of medicine that deals with the systematic classification of diseases, this section suggests a misalignment classification scheme based on three dimensions: (i) organ system, (ii) symptom/sign and (iii) etiology.

5.2.1 Misalignment Classification by Organ System

The organ system axis is a structural classification dimension. Despite the several definitions [29][30][31] proposed for Enterprise Architecture (EA), it seems consensual that it is related with the structure of the things of relevance in the organization, their components, and how these components fit and work together to fulfil a specific purpose [1]. Different EA frameworks have been proposed, throughout the years, structuring the enterprise architecture model in multiple views, each comprising a set of specific concern [2][31][32][34], often focusing on four or five viewpoints. Therefore, based on the enterprise architecture concern and the five architectural components defined by [33], we propose the following classification scheme for the organ system dimension.

Table 2. Organ System Dimension

Code	Classification Scheme Record
OA	Organizational Architecture
BA	Business Architecture
IA	Information Architecture
AA	Application Architecture
TA	Technology Architecture

Misalignments might be instantiated in this dimension by two options: (i) selecting two architectures to classify a misalignment between architectures, or (ii) select only one to classify a misalignment within the architecture.

5.2.2 Misalignment Classification by Symptom/Sign

The symptom/sign is a behavioural classification. Within disease classification scheme, this is one of the core dimensions and is particularly relevant when there is limited knowledge about the target system. To set an initial library, it was considered that misalignments symptoms/signs would be those evidences of unawareness and inefficiencies, the inability to perform some tasks, the extra effort and extra costs.

Table 3. Symptom/Sign Classification Dimension

Code	Classification Scheme Record
S.01	I am not aware of the organization's mission.
S.02	I am not aware of the organization's strategy and goals.
S.03	I do not know who the ultimate responsible for a business process is.
S.04	I do not know with whom I should speak to obtain knowledge about business processes.
S.05	I do not know what my responsibilities are.
S.06	I do not know what the expectations about my work are.
S.07	I do not know to whom I should report within the context of different activities.
S.08	I am not aware of the process contribution towards the organization goals.
S.09	I am not aware of my contribution towards the organization goals.
S.10	I do not know with whom I should speak to obtain the semantics of informational entities.
S.11	I do not know who the ultimate responsible for a business informational entity is.
S.12	I find that same entity has different semantic according to the interlocutor.
S.13	I find that different concepts and names are used to refer to same entity.
S.14	I do not have the required information to support day-to-day activities.
S.15	I do not have the required information to support decision-making.

Code	Classification Scheme Record
S.16	I find information outdated.
S.17	I do not know with whom I should speak to obtain information and help about an application.
S.18	I do not know who the ultimate responsible for an application is.
S.19	I need to repeat the login in different applications.
S.20	I spend time configuring and updating users' profiles in several applications.
S.21	I need to develop and use end user computing applications.
S.22	I cannot develop/innovate certain types of business and products.
S.23	I spend time reintroducing the same information over different applications.
S.24	I need to use different applications during the day to perform my business activities.
S.25	I spend time executing manual validations that could be automatic.
S.26	I need to repeat the same application task several times to perform a business activity.
S.27	I do not understand how to use and interpret the same concept in different applications.
S.28	I need to run queries on different applications to get a full picture over an entity.
S.29	I find information consistency problems.
S.30	I find information integrity problems.
S.31	I spend time to correct data to ensure consistency between information replicas.
S.32	I have no confidence on application's information.
S.33	I find information entities with required fields not filled.
S.34	I spent time synchronizing data between applications.
S.35	I need to keep competencies on several different technology, operating systems and DBMS.
S.36	I can't comply with the business level of service.
S.37	I have frequent periods where applications are unavailable.
S.38	I find that batch processes are not completed during the non-working period.
S.39	I spent extra resources and costs with new developments facing information volume increase.
S.40	I have found unprotected confidential information.
S.41	I have found that users have access to information not required for their business activities.

5.2.3 Misalignment Classification by Etiology

Etiology was adopted as a disease classification axis after several years of usage and research since it requires deeper knowledge about the system and, even in current days, the disease causes are not always clear. Nevertheless, we propose a set of preliminary etiological factors in the context of business and information systems misalignment, based on those factors that might cause or contribute to misalignments:

Table 4. Etiology Classification Dimension

Code	Classification Scheme Record
E.01	Undefined organizational strategy and organizational goals.
E.02	Undefined business process goals.
E.03	Lack of relation between process goals and organizational goals.
E.04	Undefined business roles.
E.05	Undefined responsibilities.
E.06	Undefined hierarchy or lines of reporting.
E.07	Multiple hierarchy or lines of reporting.
E.08	Insufficient business users training.
E.09	Lack of data ownership.
E.10	Poor IT planning and portfolio management.
E.11	Insufficient IT resources.
E.12	Lack of IT skills and competencies.
E.13	Lack of data quality controls.
E.14	Undefined business information requirements.
E.15	Multiple applications managing the same information.
E.16	Unavailable requirements at application level.

Code	Classification Scheme Record
E.17	Wrong requirements implemented at application level
E.18	Users managed differently in different applications.
E.19	Lack of applications interfaces.
E.20	Undefined security requirements over the information entities
E.21	Undefined capacity and performance requirements.
E.22	Under capacity infrastructure.
E.23	Insufficient involvement of business users in systems developments.
E.24	Undefined criteria to prioritize IT projects.
E.25	Undefined business service levels.
E.26	Lack of translation from business service levels to IT service levels.
E.27	Lack or poor systems performance monitoring.
E.28	Technological heterogeneity.
E.29	Obsolete technological infrastructure.
E.30	Incompatible platforms or technologies.

5.3 Business and Information Systems Misalignment Management

Once established the misalignment nomenclature and classification, the next step is the ability to manage those misalignments. In fact, Chan [11] argues that in business, change is frequent and, therefore, which might contribute to misalignments. This statement enhances the importance of misalignment management. Therefore, according to the BITAM approach, for an organization to manage misalignment it should be able do detect, correct and prevent it.

5.3.1 Misalignment Detection through Diagnosis

The misalignment nomenclature and semantic describes misalignment diagnosis as the process of identifying a misalignment by its symptoms and signs, and from the results of procedures, such as questionnaire and tests. Therefore, the Business and Information Misalignment Classification scheme, as proposed in the previous section, is itself a relevant contribution for misalignment detection, since it allows the identification of misalignments in an organization by comparison with the symptoms and signs provided by the classification scheme. Nevertheless, more structured techniques should be defined to support the diagnosis process. The BISMAM model proposes three techniques: (i) misalignment self-diagnosis, (ii) misalignment diagnosis questionnaire, and (iii) misalignment diagnosis test.

The self-diagnosis is, under medical sciences, usually supported on symptoms checklists to which the patient assigns a qualification (*Never*, *Sometimes*, *Often*) according to symptom sensation frequency. Under the BISMAM model, we propose a similar, but extended technique, supported on a matrix with symptoms/signs in rows and etiology in columns, as shown in figure 1, allowing organizations to quick assess and compare themselves in relation with typical misalignment symptoms and usual causal factors. We named "NSOC Matrix" where symptoms/signs are assessed as Never, Sometimes or Often, and the intersection cells are marked with Cause if organization realises that the row symptom is caused by the column etiological factor.

The diagnosis questionnaire is similar to the physician inquiring activity to detect and understand the symptoms and potential underlying causes for disease. This

technique is much more detailed that the one used for self-diagnosis, and is based on a questionnaire with specific diagnosis questions (DG). Because organizations are very complex systems with several actors involved, the questionnaire should be oriented to different organizational roles, ensuring that all relevant participants are involved. This is, actually, the same argument used by Zachman to define the framework perspectives. Therefore, we propose to link the DG to the different perspectives, to address the different participants view, i.e. Planner (Board), Owner (Business people), Designer (IT responsible) and Builder (IT staff).

The third diagnosis technique is focused on misalignment signs validation. As previously described in the misalignment nomenclature, signs are objective evidences of misalignment experienced by the organization and observable both to internal and external organizational actors. Therefore, similar to the physician that perform analysis and other tests, this technique supports the test or validation of misalignment signs, e.g. Perform a database integrity and consistency audit would be a diagnosis test (DT) for symptoms S.29, S.30, S.33.

	E.01	E.02	E.03	E.04	E.##	**Diagnosis**
S.01						**N**
S.02						
S.03						**S**
S.04						**O**
S.##					**C**	

Fig. 1. Misalignment NSOC Matrix: a Self-Diagnosis Tool.

5.3.2 Misalignment Correction through Therapy

Once misalignments are detected, organizations initiate realignment initiatives. This is the therapy to correct misalignments, which is a fundamental technique, as it alleviates the symptoms and corrects the misalignment factors addressing their etiology. The following table presents an initial library of therapies that might be considered for some described symptoms/signs:

Table 5. Misalignment Therapy Library

Code	Description
T.01	Define and communicate organization's mission, strategy and goals.
T.02	Define and assign business processes ownership and responsibility.
T.03	Define and assign business roles, responsibilities and reporting lines.
T.04	Define business process goals and link it to organizational goals.
T.05	Define and assign information entities ownership and responsibility.
T.06	Define and assign application ownership and responsibility.
T.07	Develop a data dictionary and promote dictionary rules and standards.
T.08	Perform business process improvement
T.09	Implement a management information system.
T.10	Develop application interfaces.
T.11	Implement a single-sign-on solution.
T.12	Implement an identity and access management solution.

Code	Description
T.13	Implement data integrity, data consistency and data quality controls.
T.14	Perform database consolidation and migrate data.
T.15	Implement a workflow system.
T.16	Implement a load balancing solution.
T.17	Upgrade application and database server's capacity.
T.18	Implement a failover solution.
T.19	Define levels of service and performance indicators.
T.20	Reprioritize the project portfolio.
T.21	Implement encryption mechanisms to secure confidential information
T.22	Implement an enterprise information integration layer.
T.23	Provide training on specific applications functionality.
T.24	Review users' profiles and access rights.
T.25	Consolidate and standardize platforms and technologies.

5.3.2 Misalignment Prevention through Prophylaxis

Prevention is the ultimate goal for any non-desired situation or state. The ability of preventing a situation is directly proportional to the ability of detecting and correcting it in a timely and planned manner. BITAM describes prevention as the third and last maturity stage in the organization's ability to deal with misalignment [11]. The following table presents a possible library of prophylaxis techniques that aim to prevent the occurrence of misalignments.

Table 6. Misalignment Prophylaxis Library

Code	Description
P.01	Organization's mission, strategy and goals shall be defined and published.
P.02	Business processes shall have an owner responsible for process update, control, quality and improvement.
P.03	Business roles and responsibilities shall be defined and assigned, and lines of reporting shall be established to different roles.
P.04	Business process goals shall be defined and linked to organizational goals, and roles operational goals shall be defined and linked to business process goals.
P.05	Information entities shall have an owner responsible for ensuring quality and accuracy, and for defining security requirements.
P.06	Information architecture with all relevant business information entities shall be identified, including concepts, semantic and alias.
P.07	Information shall have a means of being communicated to the appropriate audience using standard applications and tools.
P.08	Applications shall have an owner responsible for ensuring documentation, new developments and maintenance prioritization, availability and performance requirements.
P.09	User identification, authentication and authorizations should be managed centrally.
P.10	New business and new products launching shall be preceded by the identification of application's functionalities gaps and required developments shall be performed.
P.11	Each business process shall be supported by a minimum number of applications and each business activity shall be supported by one application.
P.12	Applications shall support efficient automatism for repeated tasks and for sequential tasks without input required.
P.13	Each information entity shall be managed by only one application that provide the services to access and update the entities it manages.
P.14	Applications shall provide data quality controls.
P.15	Technology standards shall be defined and followed by all projects.
P.16	IT service levels shall be defined, and availability/performance monitored.

Code	Description
P.17	High availability infrastructure shall be provided for high critical processes with demanding performance and availability requirements,
P.18	Applications shall be scalable to support business volume increase.
P.19	Information security mechanisms shall be implemented according to sensitive information, according to security requirements.
P.20	Information access shall be provided on a need-to-know basis, using least privilege rule.

6 BISMAM: An Holistic Model

In order to understand how the BISMAM might be applied, we present a (limited) instantiation based on a real life example depicted from a research paper [37] that proposes to represent the misalignment based on a UML relation (*insufficiency*) between business process and information systems. The following table presents the possible misalignment classification under BISMAM proposal for the three insufficiencies reported on that research:

Table 7. Misalignment Classification: An example

Insufficiency	Organ System	Symptom/Sign	Etiology
The information for control and management related with group companies is not available in real time; Being outdated.	BA-IA	S.14, S.16	E.15
Inexistence of informational support for decision making. The deliberations at top level are not assisted or supported on existing data from the different department components.	BA-IA	S.15	E.19
Replicated data and inconsistent with financial system. The same data is repeated and inconsistent between the financial and the management/control. There are no interfaces between these components.	BA-AA	S.23	E.15, E.19
	IA-AA	S.29	E.13, E.15

We believe that with BISMAM model it will be possible to establish relations between the model components. Even though that establishing such relation need to be supported by real live validation and experience, the following table presents a possible instantiation linking therapy and prophylaxis with a set misalignment symptoms/signs that might occurs together [36] and related misalignment dimensions:

Table 8. BISMAM: A Possible Instantiation

Organ System	Symptom/Sign	Therapy	Prophylaxis
OA	S.01, S.02	T.01	P.01
BA	S.03, S.04	T.02	P.02
OA-BA	S.05, S.06, S.07	T.03	P.03
OA-BA	S.08, S.09	T.04	P.04
IA	S.10, S.11	T.05	P.05
IA	S.12, S.13	T.07	P.05, P.06
BA-IA	S.14, S.15, S.16	T.09, T.10	P.06, P.07
AA	S.17, S.18	T.06	P.08

Organ System	Symptom/Sign	Therapy	Prophylaxis
BA-AA	S.19, S.20	T.11, T.12	P.09
BA-AA	S.21, S.22	T.20	P.10
BA-AA	S.23, S.24	T.10, T.15	P.11
BA-AA	S.25, S.26		P.11, P.12
IA-AA	S.27, S.28	T.14	P.13
IA-AA	S.29, S.30, S.31, S.32, S.33	T.13, T.22	P.13, P.14
TA	S.34	T.22	P.15
AA-TA	S.35	T.25	P.13
AA-TA	S.36, S.37, S.38	T.16, T.17, T.18	P.16, P.17
IA-TA	S.39		P.18
IA-TA	S.40, S.41	T.21, T.24	P.19, P.20

Therefore, with such relation, it would be possible to develop BISMAM holistic views covering and setting together all model components for each misalignment, as presented in the following table:

Table 9. BISMAM Holistic View (example)

Business and Information Systems Misalignment Model	
IA-AA	Information Architecture – Application Architecture
S.27	I do not understand how to use and interpret the same concept in different applications.
S.28	I need to run queries on different applications to get a full picture over an entity.
E.15	Multiple applications managing the same information.
QD.01	Are you aware of situations where same entity is managed on different applications?
QD.02	Which are those entities and related applications?
QD.02	Those entities have the same name and semantic within the different applications?
QD.04	Each application has a subset of the entity or are there overlaps?
QD.05	How do you ensure the entity consistency across applications?
QD.06	What are the procedures to capture the full universe information for those entities?
TD.01	Get the applications data models and identifies entities overlaps across applications.
T.14	Perform database consolidation and migrate data.
P.13	Each information entity shall be managed by only one application that provide the services to access and update the entities it manages.

An analysis to table 8, and related libraries, indicates that therapies and prophylaxis are sometimes very similar. In fact, under the medical sciences, one technique might be used both as prevention and as therapy for a certain disease (or symptoms), although with bigger effort and maybe less probability of success if used as therapy. We believe that the same rational might be applicable to the misalignment context.

7 Conclusions

This paper deals with the alignment problem, proposing a combined approach based on misalignment and medical sciences approaches - the Business and Information Systems Misalignment Model (BISMAM), a model supported on three components: (i) nomenclature, (ii) classification and (iii) management.

We believe that this paper and BISMAM is a relevant contribution to information systems research and to the business and information systems alignment problem

because: (i) establishes a nomenclature and semantics for misalignment; (ii) defines a standard misalignment classification that can be used by all organizational actors; (iii) supports the identification and understanding of misalignments through symptoms and signs; (iv) supports the identification of misalignment causes; (v) establishes techniques to detect misalignments, both by self-diagnosis and external diagnosis; (vi) facilitates the identification of possible realignment strategies; (vii) contributes to misalignment prevention through a set of guidelines. Furthermore, this model establishes the connection between misalignment symptoms and the enterprise architecture alignment dimension, allowing to transitively relating the detection, correction and prevention techniques with the architectural levels.

When comparing to other approaches, we consider that this proposal provides additional contribution since: (i) it establishes the symptoms of misalignment at a more detailed level, (ii) deals with both intra-architectural misalignments while other approaches assume that each architecture is aligned with itself, (iii) do not require to have detailed and complete representations of organization, taking advantage of the implicit knowledge that exists within the organization.

This paper also provides initial libraries for misalignment symptoms/signs and causes, as well as for correction and prevention techniques. Nevertheless, these libraries are not complete and, like disease classification schemes where therapies and prophylaxis are on continuous evolution and the procedures used today are the outcome of hundreds of years, the BISMAM model is still an initial proposal that must be validated and continuously improved.

Therefore, the very next steps in this research would be to fill the NSOC matrix by several organizations in order to validate the classification scheme in real life environments and test the therapies and prophylaxis to assess their results. Additionally, we intend to launch a site to collect and validate the model libraries.

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