Strategic Integration of Alignment Models for the IT-Business Misalignment Detection and Redress

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Abstract The information technologies era exaggerates the link between IT and business. One power eventually affects another. The current IT-business misalignment diagnostics methodologies are able to identify an issue (like SAM, SAMM, etc.), but they do not formulate a particular algorithm to eliminate the misalignment. Therefore, the goal of this study is represented with the way of eliminating the gap between IT and business via a SAM, TOGAF, and BISMAM combination. This model integration represents eminent advantages through the ability to solve misalignment issues using the proposed model. This is the novelty of this research. The core of this approach is an Enterprise Architecture discipline which divides a company into architectural levels. It guarantees a comprehensive view on the issue. Moreover, the most appropriate methodologies of IT-business accordance were evaluated for the future integration. The results were demonstrated through the model usage on the organization example.

Keywords IT-business misalignment · Enterprise architecture · Symptoms collection · Misalignment redress

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1 Introduction

The postindustrial era has made the IT-systems usage a crucial factor of competitiveness, as digitalization of business processes and mapping of information into an understandable format assists management in making decisions which are now based on more than just personal experience and intuition but also on data sources [1]. Nevertheless, information technologies may lead to negative results that can make a company lose its competitive position [2]. On the other hand, if certain resources were contributed to the achievement of an IT-business alignment state then it will give some advantage [3]: rising profit, ROI increase in IT projects, strengthening of competitive position.

The issue of IT-business alignment is widely covered in the current literature. The importance of accordance of IT and business was described in [4–8]. This evidence of the IT-business alignment benefit for the business shows that this aspect is vital to the companies [9, 10]. Moreover, IT-business alignment issue has been staying in the top of priorities for a long time until now [11, 12] (Fig. 1). This fact emphasizes the need to contribute to this topic from both research and practical points of view.

Deepening the IT-business misalignment literature it's possible to find the way of detection misalignment symptoms [14–16]. It is sufficiently appropriate but symptoms bank is not comprehensive and there is no obvious way of symptoms elimination. That is why, this study envisages the algorithm of IT-business misalignment redress. The novelty of this research is proposed model integration which is able to provide specific artifacts and set of actions to get an IT-business alignment state.

Most current research investigates [9, 13–15] IT-business alignment/misalignment in the terms of detection but they are not targeted on a specific set of actions to solve this issue. We introduce one set of such actions and demonstrate the benefits of integrated model application in the case of one company operating in electronic trade sector. So, the algorithm presented in this research in a form of a guideline of the specific IT-business misalignment symptoms eliminating via set of corrective

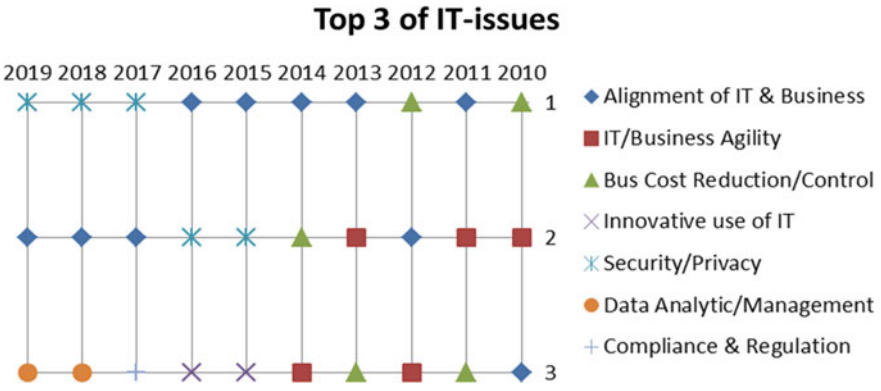

Fig. 1 Top of IT-issues (according to [12])

actions is proposed. It can be used by business analytics for a construction of aligned enterprise architecture.

In order to see misalignment symptoms it is necessary to diagnose and redress them via an enterprise architecture approach. So, the present research seeks for a way of detection and leveling of IT-business misalignment via usage of advantages of current IT-business alignment methodologies.

The paper is structured as follows: Sect. 2 describes the theoretical background of the research, Sect. 3 presents our approach to the integration of the models on the base of a concrete business case in the sector of electronic trade, Sect. 4 is dedicated to the conclusions and future directions of the research.

2 Theoretical Background and a Tools Overview

2.1 IT-Business Misalignment Definition

The current literature provides a definition of IT-business alignment [17–19] which makes it possible to formulate an IT-business misalignment definition:

1. The extent to which the IT strategy does not support/is not supported by the business strategy;
2. The extent to which the IT mission, goals, and plan are not available.

Therefore, synchronization should be established between business and IT artifacts. IT-business misalignment may be viewed in terms of the following dimensions:

1. Intellectual (strategic) dimension: the level of mutual assistance between business and IT plans/strategies. Misalignment indicates that the organization has no documented plans;
2. A structural one is the level of structural conformity of IT and acceptance of law decisions, relationships in the field of reporting, centralization/IT decentralization, and deployment of IT personnel;
3. A social one is a social status and understanding among business units and their commitment of mission, goals, and plans of business and IT;
4. A cultural one emphasizes the cultural relevance between business and IT as a precondition for everyone to plan information systems.

In this study, achieving alignment between IT and business is examined precisely from the point of view of intelligent measurement through the use of discipline in enterprise architecture and the search for symptoms.

To place the present contribution in a proper context this section outlines some related works and important concepts. In this study, we will focus mainly on the intellectual aspect of IT-business discrepancy, since most of the developed methods are aimed specifically at it. Moreover, the intellectual dimension is more measurable

than the structural one due to the documented nature of this IT-business alignment. But the other dimension should not be neglected.

The Enterprise Architecture approach provides the business and IT specialists with complete and ready-made recommendations for adjustment in order to achieve targeted business results that take into account the corresponding failures in the business. Thus, the architecture of the enterprise represents the basis for applying methodologies to avoid IT-business misalignment in the direction of matching all architectural levels to each other.

It should also be noted that the researchers mostly study the IT-business misalignment in statics, although dynamics is also important.

In this research, compliance achievement will include a tremendous work with methodologies based on IT-business misalignment in the intellectual dimension via enterprise architecture highlighting the organization's architectural levels to align each of them through symptom identification.

For now, there is a sufficiently thorough definition of the concept of IT-business misalignment, the selected dimension (intellectual) and the enterprise architecture based approach. These theoretical findings help to select proper methods to achieve an IT-business alignment state on the base of high-leveled alignment models and to establish the relationship between them on the basis of the overlapping shortcomings of each of them.

2.2 SAM

In 1991, the Strategic Alignment Model (SAM) [20] was proposed which differentiates the external and internal forces of IT and business (Fig. 2).

There are four domains of alignment:

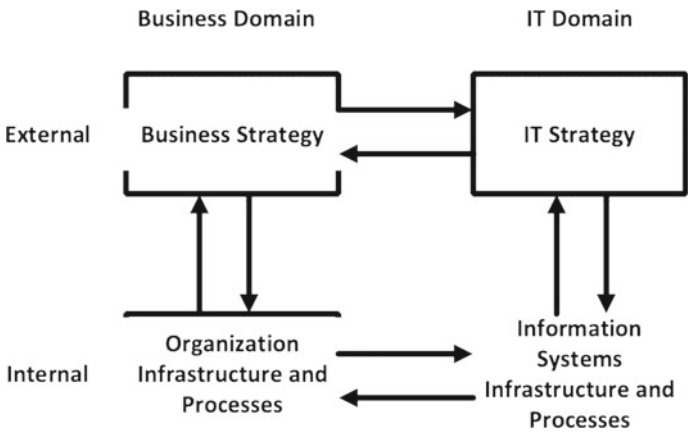

Fig. 2 Strategic Alignment Model (according to [20])

1. Business strategy (business domain) is the company's place in the external competitive environment: positioning, a competitive advantage condition, and a key success factor;
2. Organizational infrastructure and processes (business domain): organizational structure and business processes;
3. IT strategy (IT domain) is the company's place in the IT market—technologies that can form new business initiatives; information system attributes that can help support the current or create a new business strategy; diversification of available IT resources to support the business;
4. IT-infrastructure and processes (IT domain): an information system architecture, a set of applications, IT processes and, in addition, decisions that affect the time required by IT professionals to manage the corporate technical infrastructure.

Thus, there are two ways of domain integration:

1. A strategic one is business strategy + IT strategy, which means IT strategy usage to support or formulate the business strategy;
2. A functional one is organizational structure + process and IT-infrastructure to display the consistency of the requirements and expectations of employees and the capabilities of the IT department.

Moreover, SAM includes cross-domain relations called alignment perspectives (Fig. 3). It should be emphasized that at least three of four domains have to be aligned to achieve IT-business alignment.

It should also be noted that the effectiveness of the SAM model was called into question and this sounds reasonable, but this study just shows how it can be successfully used together with other models.

Despite the overall theoretical importance, this model is a conceptual one and does not propose an algorithm of achieving an IT-business alignment state.

2.3 BISMAM

The Business and Information Systems Misalignment model (BISMAM) [22] uses the terminology of medical sciences (misalignment = disease). In order to eliminate IT-business misalignment the model establishes the nomenclature and semantics of misalignment, divided into three aspects: organ system, symptom, etiology. A three-step algorithm is used:

1. Identification of inconsistencies: compare the AS-IS state of the organization with the symptoms (Figs. 4 and 5)
2. Correction of symptoms via therapy (Figs. 6 and 7).
3. Prevention of the non-compliance: use the collection of preventive measures (Figs. 8 and 9) to prevent reoccurrence of the same situation (Figs. 10 and 11).

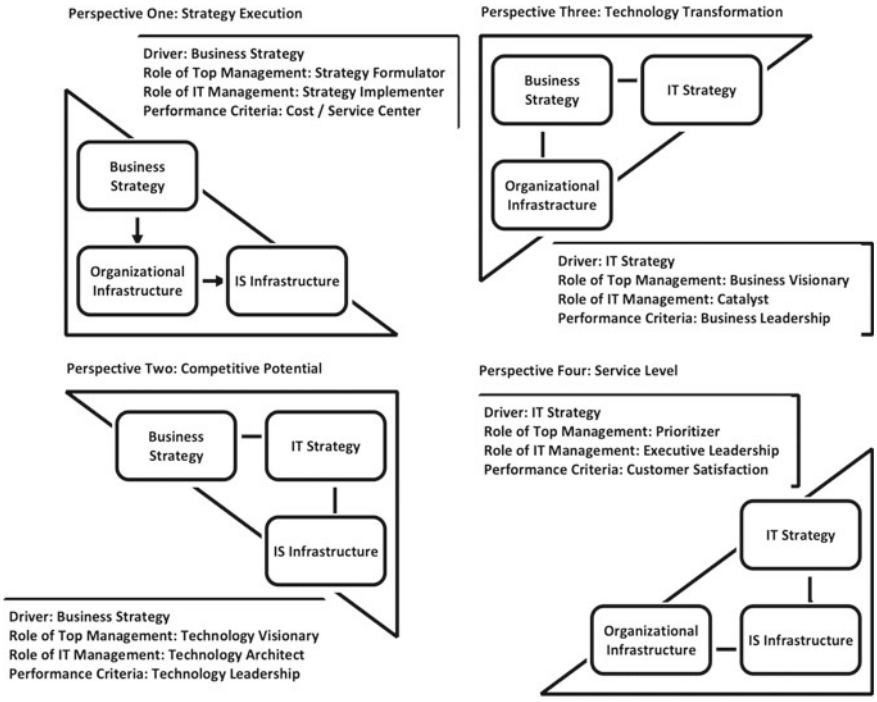

Fig. 3 Alignment perspectives (according to [20])

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.

Fig. 4 Symptoms library (1/2) (according to [22])

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.

Fig. 5 Symptoms library (2/2) (according to [22])

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.

Fig. 6 Therapy library (1/2) (according to [22])

This generalized approach resembles the methods of systemic thinking and analysis: the methods are universal for situations and can be used in organizations engaged in various subject areas.

On the figures above OA, BA, IA, AA and TA mean Organizational, Business, Information, Application, and Technology Architecture. Despite the architectural and system approach, this model neglects the driving forces of alignment and has no documented artifacts which help to resolve the IT-business misalignment issue.

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.

Fig. 7 Therapy library (2/2) (according to [22])

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.

Fig. 8 Prophylaxis library (according to [22])

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.

Fig. 9 Prophylaxis library (according to [22])

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

Fig. 10 Proposed solution (prophylaxis and therapy) (1/2) (according to [22])

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

Fig. 11 Proposed solution (prophylaxis and therapy) (2/2) (according to [22])

2.4 Luftman's Symptoms

The BISMAM symptom base covers many of the possible manifestations of IT-business misalignment; however, it does not cover all its aspects.

Therefore, the symptom bank was expanded with a collection of Lufthman's symptoms [23]. These are precisely the symptoms that are associated with similar BISMAM symptoms in terms of expressing IT-business misalignment of the same aspect, which means that they can be "cured" with the same treatment and prevention measures. The symptoms of Luftman are presented in Fig. 12. They extend the bank of BISMAM and improve the indicators collection.

3 Integration of Models

Now it is time to add some novelty to all mentioned models and approaches (Fig. 13).

Our approach is based on the searching for similar notions in analyzed models and making generalization of the concepts. The final result in this phase may be represented as a catalogue of actions and further as a software program.

The first integration of SAM and TOGAF was done in [24] (Fig. 13) demonstrating that it leads to overlapping the drawbacks of one another: one (SAM) takes

LF1	Lack of understanding between IT and business representatives	LF6	Redundancy of developed systems
LF2	Lack of vision / strategy	LF7	Lack of system competencies (key IT capabilities that create competitive advantage)
LF3	Lack of effective communication channels between IT and users	LF8	Difficulties in integrating systems
LF4	Continuous conflicts between business and IT	LF9	Dissatisfied users/complaints
LF5	Performance degradation		

Fig. 12 Luftman's symptoms (according to [23])

SAM integration domains		Business Domains		IT Domains			
		Business Strategy	Organizational Infrastructure and Processes	IT Strategy	IS Infrastructure and Processes		
TOGAF	**Architecture domains**	Business Architecture		IS Architecture	Application Architecture	Data Architecture	Technology Architecture
	ADM phases	Phase A	Phase B	Phase C	Phase C (Applications)	Phase C (Data)	Phase D
	Artifacts	*Stakeholder *Map Matrix Value Chain *Diagram *Driver/ Goal/Objective Catalog	*Driver/ Goal/ Objective Catalog *Role Catalog *Business Service/Function Catalog *Process/Event/ Control/Product Catalog *Contract/Measure Catalog *Business Interaction Matrix *Business Footprint Diagram *Functional Decomposition Diagram *Goal/Objective/ Service Diagram *Business Use-Case Diagram *Organization Decomposition Diagram *Process Flow Diagram	*IT Strategy	*Application Portfolio Catalog *Application/ Function Matrix *Application Interaction Matrix *Application Use-Case Diagram *Process/ Application Realization Diagram *Software Distribution Diagram	*Data Entity/ Data Component Catalog *Data Entity/ Business Function Matrix *Application/Data Matrix	*Technology Standards Catalog *Technology Portfolio Catalog *Application/ Technology Matrix *Platform Decomposition Diagram *Processing Diagram

Fig. 13 SAM and TOGAF [21] integration (according to [24])

into account the perspective of IT-business alignment; another proposes some artifacts, which should be developed according to the chosen perspective. We will go deeper than the SAM + TOGAF integration and propose the dynamic measure for prophilaxy. Though these approaches contain different terminology, it was possible to align it partially. The IT-business alignment by means of terminology alignment constitutes a new promising branch of further research. Firstly, BISMAM and the Luftman's symptoms indicate where something is misaligned. That is why the BISMAM symptoms were associated with the Luftman's ones (column 1, 3 of Fig. 12).

The principle of association means that each Luftman's symptom is of a nature similar to the selected BISMAM one. This rule is convenient because similar symptoms cover a misalignment issue wider. Secondly, these symptoms were embedded into the artifacts of ADM phases on the SAM basis. Thus, if we find a symptom, this will enable us to understand what artifact should be developed and what therapy/prophylaxis should be used (column 2, 4 of Fig. 12).

Thirdly, there will be an example of usage of the integration of these models.

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Thirdly, there will be an example of usage of the integration of these models. (Fig. 14).

If an individual desires to use this model integration, he/she should perform the following sequence of acts in order to avoid IT-business misalignment symptoms and balance the IT and the business sphere of such individual's organization.

1. Define what IT-business alignment perspectives prevail in the organization and select those that must be supported (SAM, Fig. 2);
2. Identify IT-business misalignment symptoms (BISMAM, Luftman) via interview and analysis of stakeholders (Figs. 6, 7 and 10);
3. Conduct therapy and prophylaxis via elaboration of artifacts within the ADM model (TOGAF) which should be taken into account according to the symptoms (Fig. 11) in the order defined by alignment perspectives.

Now we demonstrate some cases of the derived algorithm application. It represents more than just a detection tool, but the tool that proposes a specific set of actions:

Example 1 (Fig. 13):

- Identified symptoms of non-compliance: S1, S2, S3, LF2
- SAM Perspective: Strategy Execution
- ADM phase sequence: A, B, C, D
- Treatment. T1: define the mission, goals, strategies, and allocate them to employees (Principal Catalog, Driver/Goal/Objective Catalog); T2: Identify and appoint owners and responsible business processes (Role Catalog, Process Flow)

Symptom	Artifact	Symptom	Artifact
S.01	Principle Catalogue	S.22	Application/ Technology Matrix
S.02 /LF2	Driver/Goal/Objective Catalogue	S.23/LF6	Data Dissemination Diagram
S.03	Role Catalogue, Process Flow	S.24/LF6	Application/Data Matrix, Application/Function Matrix
S.04	Role Catalogue, Process Flow	S.25/LF7	Application Use-Case Diagram
S.05	Actor/Role Matrix	S.26/LF7	Application Use-Case Diagram
S.06	Actor/Role Matrix	S.27	Role/Application Matrix
S.07	Organization Decomposition Diagram	S.28	Application/ Data Matrix, Application/ Function Matrix
S.08/ LF1	Goal/Objective/Service Diagram	S.29/LF8	Logical Data Diagram, Data Dissemination Diagram
S.09/LF1	Goal/Objective/Service Diagram, Process Flow Diagram	S.30/LF8	Conceptual Data Diagram Logical Data Diagram, Data Dissemination Diagram
S.10/LF4/ LF9	Role/Application Matrix, Application/ Organization Matrix	S.31/LF8	Conceptual Data Diagram, Logical Data Diagram, Data Dissemination Diagram
S.11/LF4/ LF9	Role/Application Matrix	S.32/LF8	Application/ Data Matrix
S.12/LF1	Role/Application Matrix	S.33/LF8	Data Entity/Data Component Catalogue
S.13/LF1	Conceptual Data Diagram	S.34	Application/ Technology Matrix
S.14	Data Dissemination Diagram	S.35	Technology Portfolio Catalog
S.15	Data Dissemination Diagram	S.36/LF5	Technology Standards Catalogue Application/ Technology Matrix
S.16	Interface Catalog	S.37/LF5	Environments and Locations Diagram
S.17/LF3	Role/Application Matrix	S.38/LF5	Technology Standards Catalog, Application/ Technology Matrix
S.18/LF3	Role/Application Matrix	S.39/ LF5	Application/ Technology Matrix
S.19/LF8	Application Interaction Matrix	S.40	Data Dissemination Diagram, Data Entity/ Business Function Matrix
S.20/LF8	Data Entity/ Data Component Catalogue	S.41	Data Entity/ Business Function
S.21	Application/ Technology Matrix, Technology Standards Catalog, Application/ Function Matrix		

Fig. 14 BISMAM and the Luftman's symptoms linked with TOGAF artifacts in terms of ADM

- Prevention. P1: Identify and communicate the mission, strategy, and goals of the organization; P2: Identify and designate owners and responsible business processes.

This example is presented in Fig. 15.

In Fig. 15 AA, DA and TA mean Application, Data, and Technology architecture. Another example has alternative SAM perspective, so the tabular structure representation should be the same but with another order of SAM domains, architectural domains, and ADM phases.

Example 2:

- Identified symptoms of non-compliance: S7, S8, S9, LF1
- SAM Perspective: Competitive Potential
- ADM phase sequence: C, A, B, D

(SAM) perspective	Strategy Execution							
(SAM) Domains	Business strategy	Organizational Infrastructure and Processes	IT strategy	IS Infrastructure and Processes			Treatment (BISMAM)	Prophylaxis (BISMAM)
Architecture domain	Business Architecture		IS Architecture	AA	DA	TA		
ADM Phases (TOGAF)	A	B	C	(Application)	(Data)			
Symptoms (BISMAM+ Luftman)								
S.01	Principle Catalog						T1	P1
S.02/LF2		Driver/Goal/ Objective Catalog						
S.03		Role Catalog Process Catalog					T2	P2

Fig. 15 Example of model integration

- Decision. T3: Define and assign business roles, responsibilities, and reporting lines (Organization Decomposition Diagram); T4: Define the goals of business processes and associate them with the goals of the organization (Goal/Objective/Service Diagram, Process Flow Diagram)
- Prevention. P3: Define and assign business roles, responsibilities, and reporting lines; P4: Define the goals of business processes and their relationship with organizational goals.

In an analyzed company, there exists the prospect of an IT-business alignment—technological potential. As a rule, a business formulates what it needs in order to attract users and make the product more competitive, and IT already decides how to do this in the shortest possible time.

According to the TOGAF-ADM development model and integration with SAM: the phase sequence will be as follows: CABD.

1. SAM: Business strategy (TOGAF ADM: A)
    1. S.01 (Principle Catalog)
        - T.1 Define and communicate the mission, strategy, and goals of the organization
        - Recommendation: to declare the mission, strategy, and goals of the organization periodically—once a year the general director of the company comes to motivate employees—let him mention the organization's guidelines and they should be placed on the information stand (Principle Catalog).
    2. SAM: IT-infrastructure (TOGAF ADM: C (Application))
    3. LF.04 (Actor/Role Matrix)
        - T.5 Identify and designate owners and responsible information entities
        - Recommendation: misunderstanding may arise due to the fact that it is not clear who is responsible for what, in order to clarify this, there must be a document (Actor/Role Matrix), with which you can determine who can be contacted.. SAM: IT-infrastructure (TOGAF ADM: C (Data))
    4. LF.06 (Data Dissemination Diagram)
        - T9 Implement information systems management
        - Recommendation: create a data distribution diagram to determine which data to send to which application. All these recommendations were accepted by the organization as the base for IT-business alignment realizations.

To recap the integration, this set of acts has several advantages:

1. It considers the architectural levels, which guarantees that there will be no improvement of one aspect of the organization that leads to degradation in another one;

2. It offers not just the identification of an IT-business misalignment state, but also some advice as to what to do and what artifacts to elaborate;
3. The set of actions is more specific due to the extended symptom diagnostics and the choice of an alignment perspective.

To sum up, this new algorithm has no analogues and provides great assistance in making an organization more IT-business aligned. That is the crucial novelty of the research. This research can also be continued on the field of models validation [25–28], using the approach adopted in [29].

4 Conclusions

All in all, the result of this research is the novel algorithm of an Enterprise Architecture based approach to the IT-business misalignment detection and redress with an extended symptoms collection. There were defined misalignment symptoms and the diagnostics method.

The goal of the research is the search for a way of detection and leveling of IT-business misalignment via usage of advantages of current IT-business alignment methodologies. To emphasize, the novelty of the research is a proposed algorithm of IT-business misalignment redress.

The search for a way of detection and leveling of IT-business misalignment via usage of advantages of current IT-business alignment methodologies was successful. It was presented as the linkage between BISMAM and the Luftman's symptoms and the artifacts of ADM phases of the TOGAF methodology which takes into account strategic alignment perspectives of the SAM-methodology.

Moreover, there was the demonstration of model usage to solve misalignment issues of one IT-company. Thus, it shows how an integrated model is effective on the real case.

Notwithstanding the multiple linkages to get an integrated model, there can be some further study directions:

1. A computer automation of the algorithm;
2. Extension of the IT-business misalignment symptom library collection;
3. Extension of the IT-business misalignment therapy library collection.
4. A comparison analysis with other known methods.
5. A realization of a concrete artifact realizing the overall approach of misalignment symptoms detection and a targeted prophylaxis.

References

1. Mendelson, E. (2016). Exposed: Desire and disobedience in the digital age. In Workshop on Enterprise and Organizational Modeling and Simulation (pp. 214–232). Cham: Springer.
2. Legner, C., et al. (2017). Digitalization: Opportunity and challenge for the business and information systems engineering community. *Business & Information Systems Engineering, 59*(4), 301–308.
3. Chi, M., Huang, R., & George, J. F. (2020). Collaboration in demand-driven supply chain: Based on a perspective of governance and IT-business strategic alignment. *International Journal of Information Management, 102062.*
4. Al-Surmi, A., Cao, G., & Duan, Y. (2020). The impact of aligning business, IT, and marketing strategies on firm performance. *Industrial Marketing Management, 84*, 39–49.
5. Schlosser, F., Wagner, H. T., & Coltman, T. (2012). Reconsidering the dimensions of business-IT alignment. In *2012 45th Hawaii International Conference on System Sciences* (pp. 5053–5061). IEEE. Khaiata, M., & Zualkernan, I. A. (2009). A simple instrument to measure IT-business alignment maturity. *Information Systems Management, 26*(2), 138–152.
6. Sledgianowski, D., & Luftman, J. (2005). IT-business strategic alignment maturity: A case study. *Journal of Cases on Information Technology (JCIT), 7*(2), 102–120.
7. Nickels, D. W. (2004). IT-Business Alignment: What we know that we still don't know. In *Proceedings of the 7th Annual Conference of the Southern Association for Information Systems* (Vol. 79, pp. 79–84).
8. Hu, Q., & Huang, C. D. (2006). Using the balanced scorecard to achieve sustained IT-business alignment: A case study. *Communications of the Association for Information Systems, 17*(1).
9. Sharma, S., & Behl, R. (2020). Strategic alignment of information technology in public and private organizations in india: A comparative study. *Global Business Review*, 0972150919893839.
10. Gerow, J. E., Grover, V., Thatcher, J., & Roth, P. L. (2014). Looking Toward the Future of IT–Business Strategic Alignment through the Past. *Mis Quarterly, 38*(4), 1159–1186.
11. Luftman, J. (2003). Assessing IT/business alignment. *Information Systems Management, 20*(4), 9–15.
12. The Global IT Trends Survey (2019). Retrieved from http://www.globaliim.com/
13. Őri, D. (2015). Towards detecting misalignment symptoms: An alignment perspective-driven architecture-matching framework.
14. Őri, D. (2017). Misalignment symptom detection with XML-based enterprise architecture model analysis. In *CEUR Workshop Proceedings* (Vol. 1859, pp. 153–157).
15. Őri, D., & Szabó, Z. (2017). Pattern-based analysis of business-IT mismatches in EA models: Insights from a case study. In *2017 IEEE 21st International Enterprise Distributed Object Computing Workshop (EDOCW)* (pp. 92–99). IEEE.
16. Szabó, Z., & Öri, D. (2017). Information strategy challenges in the digital era how enterprise architecture management can support strategic IS planning. In *2017 11th International Conference on Software, Knowledge, Information Management and Applications (SKIMA)* (pp. 1–8). IEEE.
17. Al Ghazi, A., Li, M., Cui, T., Fosso, S., & Shen, J. (2017). Exploration of the misalignment between business and it strategic objectives in public-sector organisations: An empirical study in Saudi Arabia. In *Workshop on E-Business* (pp. 15–28). Cham: Springer.
18. Reich, B. H., & Benbasat, I. (1996). Measuring the linkage between business and information technology objectives. *MIS Quarterly*, 55–81.
19. Jacobs, J. (2002). Gartner's collaboration glossary. Gartner Report.
20. Henderson, J. C., & Venkatraman, H. (1999). Strategic alignment: Leveraging information technology for transforming organizations. *IBM Systems Journal, 38*(2.3), 472–484.
21. Harrison, R. (2018). Togaf (r) 9 Foundation study guide. Van Haren.
22. Carvalho, R., & Sousa, P. (2008). Business and Information Systems Misalignment Model (BISMAM): An holistic model leveraged on misalignment and medical sciences approaches. *Proceedings of BUSITAL, 8*, 105.

23. Luftman, J. N. (2003). *Competing in the Information Age: Align in the Sand*. Oxford University Press.
24. Ivanova, M., & Malyzhenkov, P. (2018). The intellectual dimension of IT-business alignment problem: Alloy application. In *Workshop on Enterprise and Organizational Modeling and Simulation* (pp. 153–168). Cham: Springer.
25. The Standish Group (2015) Chaos Report : http://www.standishgroup.com/.
26. "Why Doesn't the FEA Work".https://www.ech-bpm.ch/sites/default/files/articles/why_doesnt_the_federal_enterprise_architecture_work.pdf .
27. Zelenkov, Y. (2015). Business and IT alignment in turbulent business environment. In *International Conference on Business Information Systems* (pp. 101–112). Cham: Springer.
28. Renaud, A., Walsh, I., & Kalika, M. (2016). Is SAM still alive? a bibliometric and interpretive mapping of the strategic alignment research field. *The Journal of Strategic Information Systems, 25*(2), 75–103.
29. Babkin, E., Malyzhenkov, P. V., Ivanova, M., & Ponomarev, N. (2019). A methodology for automatic formal verification of enterprise architecture. . *International Journal of Information System Modeling and Design., 10*(1), 1–19. https://doi.org/10.4018/IJISMD.2019010101,ISSN:1947-8186