# Business IT Alignment — Where should we go: a View from Practice

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Abstract. *Strategic business IT alignment has been conceptualized and researched through two distinctly different approaches, both with weaknesses when considered from the practitioner perspective. The first from strategic management research assesses "fit" quantitatively as a holistic concept, but cannot open up the underlying enterprise design logic. The second from architecture and engineering method research is focused on the enterprise design in full, and as a consequence overwhelms in detail. Both lack an organizing foundation for developing cumulative knowledge.*
*Our objective is to derive a way forward, by zooming in on the alignment decisions that practitioners perform. Adopting a design science research method, we propose a new domain-based conceptualization that matches practitioner competency areas, with alignment reasoning across. Our operationalization results in three artifacts: domains cover coherent areas of subject matter that reduce contingencies, alignment artifacts envelope underlying designs and extract essential alignment attributes that suppress irrelevant detail, and a knowledge model provides the organizing template for accumulation of actionable knowledge connected to domains and artifacts.*
*We evaluate our approach using criteria for artifact soundness, elaborating a case from practice, populating the knowledge model with existing artifact centric research, and expert interviews. We conclude that our proposed approach takes the middle ground and can integrate with both existing approaches, and provides an excellent case for further research into the nature and structure of theorizing in the broader IS.*

Keywords. Business-IT alignment • Strategic alignment • Enterprise architecture • Practitioner • Artifact • Domains • Knowledge model • Design science • Alignment re-conceptualization

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## 1 Introduction

Since its inception by the seminal work in the 90s (Henderson and Venkatraman 1993; Luftman et al. 2015; Venkatraman 1989), research on business-IT alignment (BITA) has been a significant area of continued interest over the years for both researchers (Chan and Reich 2007; Coltman et al. 2015) and practitioners (Forrester 2023; Gartner 2019; Luftman and Ben-Zvi 2010).
Two distinctly different research streams have de-

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veloped, with their own conceptualization and research approach. The first defines alignment as a holistic concept (Chan and Reich 2007; Coltman et al. 2015) that assesses the *fit* between business and IT strategy and business and IT operations — the four quadrants of the strategic alignment model (SAM) introduced by Henderson and Venkatraman (1993). It has its roots in the systemic view proposed in strategic management research in developing the concept of *fit* between organizational structure and strategy (Van de Ven and Drazin 1985), and has adopted the research approach from this field that relies on quantitative assessments. It measures fit across large number of samples to find associations with determinants, using questionnaires on strategy and structure, macroscopic measures of performance, and statistical analysis to explore associations.

The second defines alignment as a detailed set of dependencies between layers of modeling entities that cover the design of an enterprise's business and IT infrastructure and operations, and its strategic goals (Lankhorst 2012, 2017). It has its roots in methods such as enterprise architecture (TOGAF 2023) and enterprise engineering (Proper et al. 2013) that focused initially on enterprise construction, later integrating these with strategic modelling approaches (Kaidalova et al. 2017; Khademhosseinieh and Seigerroth 2011). This approach is method focused (Brinkkemper et al. 1999), and highly detailed as it aims for full elaboration to guide construction (Lankhorst 2012) and manage overall coherence (Proper et al. 2017). For fact based findings it relies on qualitative case based research.

**Practitioner knowledge**

From the perspective of a practitioner with responsibility for aligning enterprise structure and strategy, both approaches have weaknesses. To create aligned enterprise structure and strategy, practitioners need knowledge, methods and experience connected to the artifacts that they work with in their area of competency in the strategic and operational design spaces of the SAM.

The introductory example in Tab. 1 of a company with a global product mix that is considering regional differentiation, demonstrates the alignment decisions that practitioners need to take.

| **Diversifying a global portfolio** |
| --- |
| A globally centralized product company is adopting a strategy of regional diversification, with the help of new regional partnerships, and an increased culture of employee innovation. Practitioners such as the company's strategist, the business change manager, the alliance manager and the innovation officer need to take decisions on how to localize parts of the *production*, how to organize the *transformation*, how to *govern* the acquisition of partners, and how to develop employee *innovation*.<br>For the *production model*, the approach adopted relies on balanced expansion of the regional capability in those areas with largest market potential and innovation strength, while leveraging the full corporate set in other areas. The pacing of the *transformation model* is designed to match the speed of the build-up of the capabilities of the regional business units so that it does not exceed their absorptive capacity (Zahra and George 2002). The delegation of the right to acquire regional partners is limited in the *governance model* to those with a profile that does not exceed the projected build-up of local capabilities. And in the *innovation model* targeted accelerator programs are created for employee innovation in those areas that match the regional capability buildup and the regional partnership selection.<br>The alignment decisions that are the key justification communicated to stakeholders, focus on the most relevant attributes only.e. g. the centralized versus decentralized capability balancing, the pacing of the transformation, the constraints on the delegation of partner acquisition, and the targeting of accelerator programs. |

*Table 1: Example of practitioner alignment decisions*

As the example illustrates, practitioners in their area of competence focus on artifact patterns and the key differentiators that explain their choices. For example, selecting an evolutionary transformation pattern with its pacing set to match the absorptive capacity of the regional business units. The research that will benefit them is research that returns 'actionable' knowledge related to these patterns and differentiators.e. g. which patterns exist (for example *evolutionary* versus *revolutionary* transformation), on which essential attributes do they differentiate (for example *pacing*), and how do these differentiators match different strategies both within a specific area of competence as well as in related areas. Alignment at this level is not concerned with the full construction detail, this is left to the expertise of practitioners themselves.

**Weaknesses in existing approaches**

Neither of both existing approaches can provide the type of knowledge as identified in the example in Tab. 1. The holistic quantitative approach that relies on statistical associations across the full SAM (Campbell et al. 2005; McLaren et al. 2011; Schryen 2013) can only resolve a limited set of dependencies between determinants and outcome across the SAM, and these dependencies do not reveal the underlying causal relationships for the specific artifacts of the example. Compare this to large scale quantitative research using surveys across populations on health related determinants: *not smoking* and *exercise* contribute to a *healthy lifestyle* with a higher life expectancy that can be quantified, but it needs qualitative research that opens up the *design* of the body to understand the causal relationships that underlie explanatory theories. This type of research cannot, therefore, sufficiently produce the actionable knowledge (Coltman et al. 2015; McLaren et al. 2011) that practitioners need who are responsible for enterprise design.

The engineering focused qualitative approach on the other hand (Lankhorst 2012, 2017) elaborates the construction with so much detail that the essential alignment aspects from the example do not surface. Although this type of approach has been positioned as a tool to translate strategy in action and to perform business-IT alignment (Gregor and Martin 2007; Ross et al. 2011), the focus is not so much the alignment on essential aspects but rather the full elaboration of the overall design and the coherence there off (Labusch and Winter 2013; Proper et al. 2017). In addition, most research in this approach is method oriented, research on subject matter contents, e. g. the different patterns of artifact instantiations and context dependency (such as the patterns from the example in Tab. 1) has occurred only spot wise, and certainly not organized from an alignment perspective.

**Way forward**

As a way forward, we propose in this paper a new domain based, artifact centric re-conceptualization of alignment. It bridges between both existing approaches to avoid their weaknesses, and can integrate with them as well to leverage their strengths. Adopting an artifact-centric view is the premise of Design Science Research (Hevner et al. 2004; March and Smith 1995), the discipline that developed in response to the then prevalent emphasis in IS research using the quantitative methods from strategic management research to assess macroscopic effects, such as impact on enterprise productivity of IT (Orlikowski and Iacono 2001)). DSR places the artifacts – the *constructs*, *models*, *methods* and *instantiations* (March and Smith, 1995) – that practitioners work with in the center of the research focus with the explicit intent to develop theories of artifact design and behavior that address practitioner needs. In developing our re-conceptualization of alignment, we will leverage findings on how theories on artifacts should be composed and how the knowledge can be structured. Where in most areas of IS research, DSR has become an established approach, to the best of our knowledge it has not been applied to the field of business IT alignment yet.

**Our re-conceptualization of alignment**

Our proposed re-conceptualization of alignment consists of the three outputs of this study included in Fig. 1.

*Alignment artifacts* (bottom part in Fig. 1) such as the production, transformation, governance and innovation model from the example in Tab. 1, envelope the subject matter contents that practitioners work with. They ignore irrelevant detail and focus on the essential alignment characteristics of the underlying design. They are connected into alignment chains, with artifact attributes and relationships that are used by practitioners to identify differentiating characteristics and reason about alignment. On top of this subject matter contents, *Domain model* and *Knowledge model* (top part of Fig. 1) provide a meta-level.

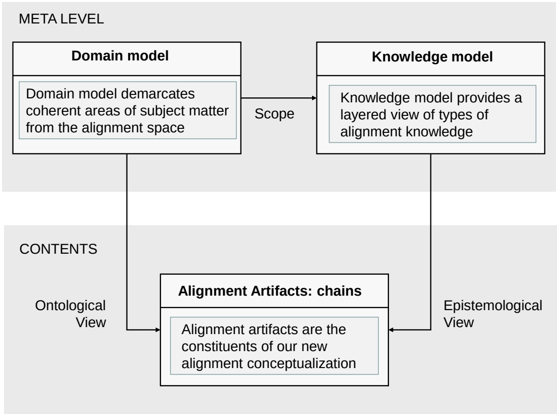


*Figure 1: Overview of the three outputs from this study*

The *Domain model* refines the full business and IT alignment space into areas of coherent subject matter. The coherent detailing reduces the contingencies that dominate the strategic management approach, and is sufficiently coarse grained to abstract from the details that dominate the engineering approach. We will propose a model that consists of a 3 x 5 matrix with two dimensions[1] : *alignment process* (covering strategy, operations and construction) and *subject matter contents* (covering production, transformation, governance, innovation and culture - as in Tab. 1). It provides for an ontological foundation of the alignment space that defines its constituents and how to scope scientific inquiry and building of practitioner competence.

The *Knowledge model* (upper right quadrant in Fig. 1) models different types of insights on alignment artifacts. We will propose three levels: from *basic knowledge* on artifact existence, through *justificatory knowledge* with causal explanations that underlie alignment patterns and barriers, to *foundational knowledge* with grand theories for a domain. It provides for an epistemological view of the alignment space that defines how insights on artifacts are gained and structured.

[1] Analogous to those that Henderson and Venkatraman (1993) define in their SAM, but with extended values.

**Objectives**

The objectives that we intend to achieve with our approach are twofold:

- Practitioners in their area of competence should be able to effectively base their alignment practices on the conceptualization we propose, and will be able to effectively derive actionable knowledge from results of alignment research by underpinning choices with results from the knowledge model.
- Researchers should be able to provide actionable knowledge to practitioners, by organizing results of alignment research into the proposed knowledge model at different levels of genericity, and will be able to develop better grounded theories by scoping their research on domains and on the layered approach to knowledge development.

**Research question**

The research questions[2] that we pursue – given the re-conceptualization we propose and the objectives to be achieved - is threefold:

- RQ 1: How can the full alignment field be partitioned into domains of coherent subject matter, for which actionable knowledge can be derived that is relevant for practitioners and that will open the field for new research perspectives. Key questions are: “which” are the partitioning viewpoints, and “how” do these produce coherent domains?
- RQ 2: How can alignment be re-conceptualized artifact centric? Key questions are: “which” alignment artifacts in these domains exist that alignment can be based upon, “how” can they be chained into alignment relationships, and “how” do practitioners use them to reason about alignment?
- RQ 3: How can a body of knowledge be developed that is connected to practice. Key questions are: “which” types of knowledge are

[2] We follow the approach proposed by Thuan et al. (2019) to detail research questions with a phrasing that focuses on the ‘which’ (addressing the contents, i. e. the models), and ‘how’ (addressing the process, i. e. the method).

required by practitioners, "which" is the foundation that this knowledge is grounded in, and "how" does research produce this knowledge?

**What follows**

The paper is structured as follows. First the Research method section explains the steps taken to produce results. Then the main body of the paper follows that is divided into three major parts. These design the Domain model, the Alignment artifacts, and the Knowledge model. The Evaluation section that follows evaluates these proposed artifacts against criteria for artifact soundness and utility. In addition it introduces the empirical evidence that we have collected that is included in Appendices B, C and D. And compares and integrates our approach with the two available approaches. A Discussion section assesses topics such as weaknesses, future work and impact on research and practice. It positions BITA as a case with potential for developing insights on theorizing in the broader IS. The Conclusion section provides an overview of our contribution to research and practice. Four appendices are attached. Appendix A contains an analysis of Related work for both current approaches. Appendix B provides a full elaboration of our alignment reconceptualization using a digital transformation case from the practice of the authors. Appendix C classifies representative research papers into the levels of the knowledge model. Appendix D contains the results of an assessment by an expert panel.

## 2 Research Method

In addition to using findings from DSR research to help define outputs such as the Knowledge model, we also apply DSR as a research method to produce the three outputs of our research that are artifacts themselves. We identify the problem and motivation, define the objectives, design and develop our proposed artifact, evaluate, and communicate - conducting the process according to the proposal by Peffers et al. (2007). Our level of analysis is the enterprise level where enterprise wide artifacts are created by practitioners.

**Motivation, Problem and Objective**

To assess both available approaches, we rely on our analysis of the literature. From the body of literature available on strategic alignment, we establish a selection of landmark papers that are broadly cited (Henderson and Venkatraman 1993; Luftman et al. 2015) and high impact review papers (Chan and Reich 2007; Coltman et al. 2015), and we use broad search terms (alignment, enterprise transformation, etc) as entry points for forward (cited) and backward (citing) explorations of papers that allow us to gain insights in the historic roots and various developments. For the engineering method focused stream we adopt a similar approach but with a more recent focus, and in addition select relevant research from conferences that address competency practices (such as ECIS and ICIS conferences), and the DSR community (such as the DESRIST conference). Our analysis of knowledge that practitioners need is based both on examples from our practice as included in this paper, as well as on papers that describe shortcomings of alignment research from the practitioner perspective (e. g. McLaren et al. 2011; Vaujany 2008) and how artifact centric research should contribute to practitioner required knowledge (e. g. Hevner et al. 2004).

**Design**

To design the three artifacts from Fig. 1, we predominantly use analogies to and integration of previous research lines – a heuristics tactic (Gregory and Muntermann 2013):

- Design of the domain model adopts partitioning terminology and partitioning approaches from the engineering field, while the values for domains are based on a consolidated list from the literature from both current approaches. We use landmark papers, review papers and searches on keywords such as 'domain' and 'partition' to establish the relevant literature.
- Design of alignment artifacts and chains integrates alignment approaches from both the engineering and the strategic alignment field. The engineering centric papers that we build on are those that discuss how artifacts align with their

exterior environment, and the strategic alignment centric papers are those that present alignment as overlooking multiple design spaces.

- Design of the knowledge model builds on research on epistemological models that describe knowledge building for artifacts. We integrate findings from both IS and DSR on theory development, using landmark papers from both fields, that describe the established view of knowledge generation in each field.

**Evaluation**

We evaluate the designed artifacts against evaluation criteria that have been developed in DSR. Prat et al. (2015) identify criteria that relate to both the artifact's structure (*fidelity to modeled phenomenon*, *simplicity*, *completeness*, and *consistency*) and fit to the target audience's environment (*usefulness* and *ease of use*). We evaluate the first (the artifact's structure), by assessing how the logic that we apply to create their structure satisfies the structural criteria. We evaluate the second (fit to the target audience's environment) by providing three sources of empirical evidence: a demonstration of the approach applied to a full case from practice in Appendix B, a demonstration of how selected papers from the literature map into the knowledge model in Appendix C, and judgments of the approach by selected experts in Appendix D. Inline in the paper we present additional demonstrations of alignment reasoning drawn from the practice of the authors. Cases, papers, and experts are handpicked by the authors, selected for their ability to demonstrate the approach. For additional details on the method used to gather and evaluate the evidence in the appendices, see the inline description there.

As Venable et al. (2016) recommend we further evaluate our approach by comparing it to the two available approaches and assessing possible weaknesses and improvements.

Note that Demonstration which is a separate phase in Peffers et al. (2007) proposed method is included using inline examples in the paper, and a full case from practice in Appendix B.

## 3 Domain model

Alignment domains as we seek to define them are created primarily as a coherent foundation for researching theories and developing practitioner competence. The notion that comes closest is the concept of a *scientific* domain that Shapere (1977) introduced in the aftermath of logical positivism, in search of a new approach to scientific theorizing. Defined as "a body of information .. [with] associations based on some well-grounded, significant, relationship between the items of information which are suggestive of deeper unities among the items" as summarized by Suppe (1977, p. 686), this reflects the driving force for introducing alignment domains as a base for theorizing about the alignment space. Consequently we define alignment domains as "coherent areas of subject matter from the overall enterprise design spaces, with a deeper contextualized structure that underlies causal relationships inside and between domains".

The domain creation process that partitions the full alignment design space into domains, needs to ensure that subject matter inside domains is coherent enough in order to reduce contingencies and allow grounded theories to be developed, and to become a foundation for independent practitioner competencies to act upon. To allow multiple groups of practitioner competencies with responsibilities for different domains to work together, domains should allow for a degree of autonomy and stability (Bruls et al. 2010), yet be overall integrated. Some degree of domain mutability (Gregor and Martin 2007) is required that can support the dynamic nature of the IT industry with its rapidly changing technology environment.

### 3.1 Domain Model Creation Method

This section designs the method to create the Domain model. We first review how both existing alignment approaches approach the partitioning of the full design space, to illustrate how we build on these. The terminology that we use to identify the structure of the domain model is introduced in Tab. 2.

| Terminology: dimensions and perspectives |
| --- |
| The terminology that we use to identify the structure of the domain model is adopted from an IS method that partitions an enterprise architecture into domain architectures (Bruls et al. 2010). This approach splits the full architecture space along multiple *dimensions*, with discrete values on each dimension, identified as *perspectives*. Each intersection of perspectives on the dimensions defined creates a domain. For example, to partition an enterprise architecture two dimensions are used: the first the *layers* in a business-to-IT stack (with as perspective values *business*, *application* and *infrastructure*) and the second subject matter decompositions in each layer (with as perspective values *process* and *function* producing domains such as 'application function' and 'business process' domains.<br>Note a parallel case from the DSR domain in which a method to develop a taxonomy of IS systems (Nickerson et al. 2013) uses *dimensions* and *characteristics* as values to differentiate classes. |

*Table 2: Partitioning terminology*

### Partitioning approaches in strategic management research

Henderson and Venkatraman (1996) developed their highly influential SAM as a partitioning of the full alignment design space, using two dimensions and two perspectives on each dimension, resulting in four quadrants that cover the business and IT strategy, and the operational business and I/S infrastructure and processes. The two dimensions they use are named in terms of their alignment purpose: *strategic fit* aligns between the strategic perspective, and the operational perspective, and *functional integration* aligns between the business perspective, and the IT perspective. To label them by their contents rather than their purpose, we will refer to these dimensions as the *lifecycle* dimension through which strategic changes evolve (from strategy to operations) and *subject matter* dimension (the business and IT contents that changes are made up from).

Where most authors, including ourselves, follow Henderson and Venkatraman's partitioning into strategic and operational for the lifecycle dimension (with an extension that we will discuss), values for the subject matter dimension have been refined considerably. Chan and Reich (2007) in a major review of the seminal BITA literature until then extract a number of values[3] that illustrate that by then the field has expanded to cover many additional subject matter aspects including soft aspects like *culture* and *social interactions*. As the list is compiled 'bottom up' by abstracting from existing research papers, what is lacking is an overall view that can ensure cohesiveness of individual domains and overall integration, requirements that we identified above. Schlosser et al. (2012) propose a simplified list of subject matter perspectives that include *human* (actors), *social* (relationships) and *intellectual* (resources). Although these three more abstracted perspectives may be useful, for example to create a focus with a specific research discipline (psychology, sociology and design or engineering science), for our purpose such a focus would cut across the full subject matter and will find it difficult to produce coherent partitions of subject matter.

Saat et al. (2011)) partition solutions based upon the alignment focus (such as *business demand–driven*, *IT infrastructure–driven*, *innovation–driven*, or *compliance–driven*).[4] Their intent is to develop situated pre-configured artifacts that better match the solution that needs to be designed (Baumöl 2005). As these entry points create perspectives on the full space, they do not partition subject matter into more refined domains.

### Partitioning approaches in engineering research

In the second, engineering based qualitative approach, integrated layered models trace the linkage from strategic purpose to operational business and IT resources (Lankhorst 2012; Proper et al. 2017).

[3] Schlosser et al. (2012) in assessing this list conclude that it does not differentiate between dimensions, but integrates perspectives from both into a single list.

[4] This is a similar approach as elaborated by Henderson and Venkatraman (1993) who use any of the four SAM quadrants as entry point.

These models mostly address the *production* environment, with some attention for other modelling areas like *culture* and *governance* (Proper et al. 2017), and *transformation* (Labusch and Winter 2013), etc .

Competency focused practitioner methods cover subject matter with a focus on a specific area of design. For example, the enterprise strategy and architecture practice (*production* focus) using TOGAF, the change management practice (*transformation* focus) using MSP, and the operational management practice (*governance* focus) using COBIT and BiSL/ASL/ITIL (COBIT 2013; DID 2023; MSP 2023; TOGAF 2023). They do not provide an overall integrated view though.

Albani et al. (2016) propose to group artifacts developed by these methods into a domain map that can assess which enterprise engineering methods are complementary. As mapping of our proposed domains to competency practices is a key property that we are looking for, this idea comes close. However, our intent is the other way around: build the domain map from an integrated view, and then show that domains map to practitioner competencies.

**Domain model**

We build on the above analysis to select dimensions and perspectives. For the dimensions, we follow the consensus that has developed, starting with the work of Henderson and Venkatraman (1993). They are twofold, one the *lifecycle* dimension (in which phases alignment progresses), and the second the *subject matter* dimension (what needs to be aligned). They reflect the most basic differentiation: that between the *process* of alignment and the *contents* that needs to be aligned.[5]

**Lifecycle perspectives**

For selecting perspectives on the Lifecycle dimension we follow the differentiation between the strategic and the operational perspectives that Henderson and Venkatraman (1996) propose, again the most basic differentiation. We do extend these with a 3rd perspective: the *construction* perspective, identified in later research as well (Chan and Reich 2007; Gregor and Martin 2007; Maes 1998; Maes et al. 1999). We add this 3rd perspective because construction may have a significant imprint on operational and strategic artifacts, the result of which needs to be aligned. The simple example that Simon (1996) provides of a clock illustrates this: how it is constructed will determine its accuracy, robustness, water resistance, etc. Henderson and Venkatraman (1993) already describe how this operational imprint that stems from construction, results in strategic properties such as reliability and flexibility.[6] Later engineering research reinforces the view that the imprint that results from engineering on behavior produces deeply engrained structures (Dietz et al., 2013; Niehaves and Ortbach, 2016) that matter from an alignment perspective.

As an example, in the diversification case the new local production platforms may be implemented as distributed physical infrastructure for the regions that is federated to support common functions, or as virtualization of a central platform that offers regional business units their private views. While this delivers the same operational functionality, it has considerable consequences in terms of cost, non-functional behavior, transformation phasing, and strategic options; the decision for one or the other belongs on the table of the CIO. As this example illustrates as well, it is during engineering that the boundaries are encountered of what is possible with a given set of resources, the required investment in process, organization and resources. The competitive differentiators this may create (Porter 1985) are key insights to be taken from the construction phase.

**Subject matter perspectives**

For selecting perspectives on the Subject matter dimension, the research reviewed above from both existing approaches, offers many candidate values that combine both a physical asset related view

[5] These also reflect the two major types of artifacts that DSR identifies (March and Smith 1995): *methods* (the how to) and *models* (the what).

[6] They use the terms *distinctive* and *systemic* competencies to identify these properties at strategic and operational level.

(production related), a softer actor-related view (social, cultural) and a process-related view (transformation, governance, innovation). They are not organized yet, however, into an integrating view. The process through which we select perspectives on the subject matter dimension needs to ensure that the resulting domains are uncoupled, but remain overall integrated to coherently address the full alignment as well. The first requires the partitioning to be performed from strong centers of gravity that carve out a coherent part out of the full space, and the second that these centers come from an overall integrated view.

To perform the subject matter partitioning we rely on the concept of a *domain creation model* introduced to partition an enterprise architecture into more detailed cohesive domain architectures (Bruls et al. 2010), and used as well to partition the operational landscape of an enterprise into uncoupled partitions (Bruls et al. 2021). This approach uses as perspectives those conceptual entities that reflect the essence of the *world* for which the domain model needs to be constructed and established. Domains created in this way acquire boundedness and cohesiveness through the nomological nets of constructs that cluster around these essential entities (with their strong centers of gravity). And because the conceptual entities come from a single worldview, domains become composable. In addition, with both a core entity at their center, as well as with clusters of secondary constructs around this entity that can grow, domains both are stable as well as contain some degree of mutability.

In the world view that we base ourselves on as a base for domain creation in the subject matter dimension, we define an enterprise as a "*a sociocultural undertaking producing goods and services that through a process of innovation continuously transforms to adapt to its environment*". This definition derived from an abstracted 'essential' view, covers many of the perspectives explored in the both current approaches, but now arranged in an overall integrated view. From this "essential" definition we extract five perspectives: the *Production* perspective covers production of goods or services within a current state, the *Transformation* perspective covers transition from an existing to a new state, the *Governance* perspective covers the accountability and responsibilities through which the as-is and to-be state and the change are controlled, the *Innovation* perspective covers the exploration of new opportunities that business and technology trends bring, and the *Culture* perspective covers the non-rational beliefs that determines how employees and clients perceive the enterprise; it acts as internal motivator.

### Primary versus secondary subject matter scope

Initial research into alignment (Henderson and Venkatraman 1993) included many case descriptions of transformation journeys of individual enterprises with a focus on primary artifacts (technology and process infrastructure in support of business initiatives, governance of business and IT partnerships, required skills, etc) that contribute to the actual strategic changes in the business and IT and how that is supported by internal arrangements of operational assets. Already with the major review by Chan and Reich (2007) of the seminal BITA research, that by then has shifted considerably to the quantitative approach, the attention appears to have shifted as well for a large part to a secondary focus, the alignment process itself. e. g. how practitioners across business and IT behave and organize themselves in order to perform the arrangement of primary resources in support of strategy.[7] Coltman et al. (2015) in a second major review of seminal BITA work until then, criticize this large focus on alignment organization and process. As Ray et al. (2005, p. 626) observe "IT is deployed in support of specific activities and processes, and, therefore, the impact of IT should be assessed where the first-order effects are expected to be realized". Our examples throughout this paper (such as the Introductory

[7] This focus on alignment process shows through in the mostly behavioral recommendations Chan and Reich (2007) extract for practitioners: the advice to *share responsibility*, *share knowledge*, *build the right culture*, *focus on essentials*, *manage the IT budget* and *embrace change*.

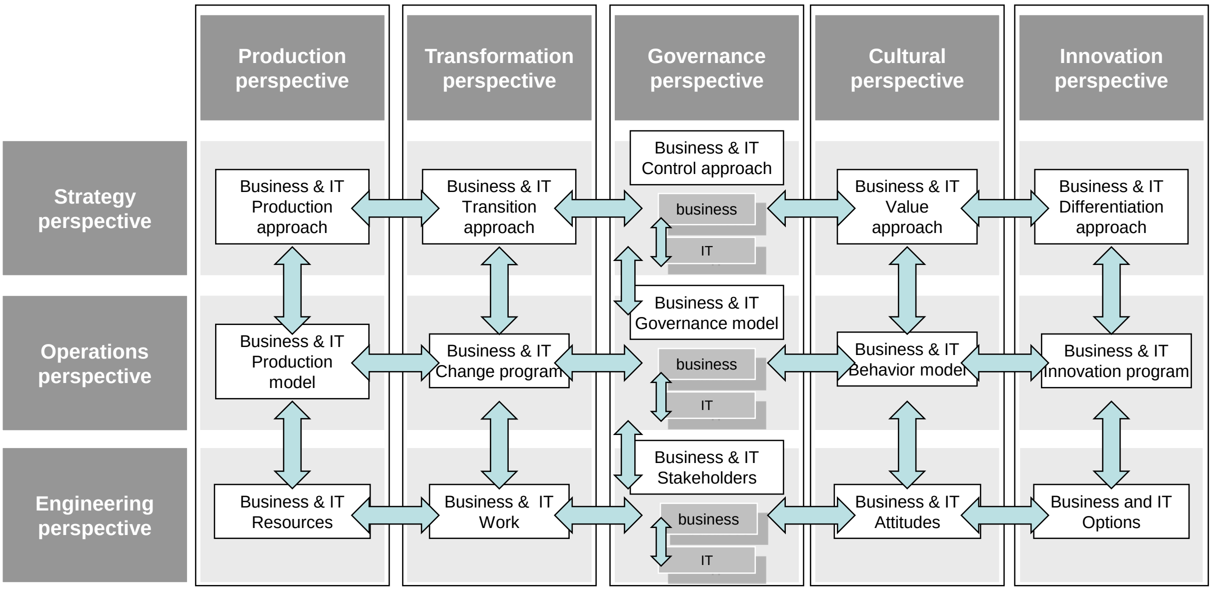


*Figure 2: Alignment domain model*

example in Tab. 1 and the case in Appendix B confirm that the knowledge required by practitioners is indeed related to the primary artifacts they work with. Although it is arguably important to understand the alignment process itself (we will for example explain in more detail the type of reasoning by practitioners and how this uses alignment knowledge), we will focus in defining domains and artifacts on primary artifacts.

## 3.2 Domain Specification

Together the dimensions and the perspectives derived in the previous section produce a 3 x 5 matrix as depicted in Fig. 2. The cells represent domains of contents created by the intersection of the perspectives on both dimensions. Each cell covers a set of competencies which practitioners need to execute specific alignment related tasks, the underlying subject matter that the practitioners work with and the research areas that researchers can connect to. The alignment artifacts that will be introduced in the next section in more detail are shown in every cell as boxes. Alignment relationships are visualized as vertical arrows inside cells between business and IT (only shown for the middle column, but applying to all), and as horizontal and vertical arrows between cells. Horizontal relationships (only shown between neighboring cells) apply between all cells in a row, vertical relationships are limited to neighboring cells in the column. No transversal relationships are intended.

**Naming of alignment relationships**

To name alignment relationships, we follow Henderson and Venkatraman (1993). The alignment between business and IT inside a cell is labeled as *functional integration* (for example how IT functions support business functions in the operations cell of the production column - the production operations domain). The alignment between the layers in a domain as *strategic alignment* (for example how a set of business and IT functions in the operations cell support a set of strategic business and IT goals in the strategic cell of the production column). We coin the term *construction alignment* for the alignment between the resources that are used to construct and the functions they deliver in the operational layer of the production column. Alignment between domains in the vertical columns (shown as horizontal arrows) is a new

| **Perspective** | **Scope** | **Accountable** |
|---|---|---|
| Production perspective | The relationship between a (new) strategic production approach implemented by an enterprise's production model (the design of its processes and systems), and its construction from business and IT resources | Chief Operating Officer (COO) together with heads of business units. |
| Transformation perspective | The relationship between transformation approaches, the change programs and the assembly from packages of work | Chief Executive Officer (CEO), Chief Information Officer (CIO) together with the heads of transformation projects/programs |
| Governance perspective | The relationship between organizational control and risk and regulatory compliance, the governance model (the operational roles and responsibilities) that implement this control and compliance, and the underlying design that maps stakeholder interests. | Chief Executive Officer (CEO), Chief Operating Officer (COO), Chief Financial Officer (CFO), Chief Risk Officer (CRO). |
| Innovation perspective | The relationship between competitive differentiators, the management of a portfolio of innovation options and their construction based upon idea generating mechanisms. | Chief Innovation Officer (CINO), Chief Technology Officer (CTO), Chief Information Officer (CIO), Chief Digital Officer (CDO) and heads of the strategic business units. |
| Culture perspective | The relationship between corporate values, the operational behavioral model (internal and external) and the attitudes that are key determinants of behavior. | Chief Marketing Officer (CMO) and Chief Human Resources Officer (CHRO). |

*Table 3: Domain contents: scope and accountability*

concept introduced by domain partitioning. As these relationships are inside the same lifecycle layer this alignment type is comparable to the functional integration between business and IT. For example, a roadmap of projects developed in the operations cell of the governance column supports transition towards the future production model developed in the operations cell of the production column. We will use the term integration for these but qualify this term with the lifecycle perspective: *strategy integration*, *operational integration* and *construction integration*.

Note that the specific sequence in which the lifecycle perspectives (Engineering, Operations, Strategy) are plotted reflects alignment reasoning: a new construction is put to use into operations and satisfies a strategic purpose, or vice versa a strategic purpose exploits an operational capability that needs to be constructed. We do not impose in our description a specific organizational setting or process that executes alignment tasks, we just provide the language to facilitate it. It may support a "sequential" view of alignment in which business and IT perform separate processes, but also more integrated views such as fusion, co–evolution and emergence that emphasize seamless integration of business and IT and that are better equipped to deal with the increasingly fluid and dynamic business and IT environments (Andersen and Nielsen 2009; Tanriverdi et al. 2010; Walraven et al. 2018).

**Foundation for practitioner competency**

The domain's scope, the artifacts they contain, and the accountable stakeholders are described in Tab. 3. The table lists domain contents split out across subject matter perspectives with the description highlighting for each subject matter perspective, the relationships between domains across the strategic lifecycle. The practitioner roles identified in Tab. 3 represent the key decision makers in large enterprises responsible for alignment (Menz 2012). These top management roles are accountable, but in practice will focus on the essential alignment aspects that feed key decisions, and delegate many of the detailed design tasks to business and IT managers that act in operational roles, enterprise strategists and architects that act in structure creating roles and change and innovation managers that act in transition and innovation management roles (De Haes and Van Grembergen 2009). As different skills are required to work with related clusters of constructs in a domain and separate enterprise stakeholders have an interest, this makes them a foundation for different practitioner competencies. Indeed, in the practitioner world, separate practitioner competency methods exist for domains from the five subject matter perspectives, albeit with different degrees of maturity. As already noted in the previous section, mature well established competency practices exist in the Production, Transformation and Governance domains, using as methods TOGAF, MSP, and COBIT and BiSL/ASL/ITIL (COBIT 2013; DID 2023; MSP 2023; TOGAF 2023). The innovation management practice (innovation focus) is more recent with developing approaches such as management of innovations as a portfolio of options (Kogut and Kulatilaka 2001; Mathews 2010). The social/cultural/informal aspects that are covered under the culture perspective have only surfaced in initial form in alignment research (Walentowitz 2012) – they do not have established competency practices yet.

Where they have a narrow focus on subject matter, the above competency methods delineate less sharply on the perspectives across the strategic lifecycle. Most methods initially started with a focus on construction, over the years (as explained in more detail in Appendix A) extending to the operational and even the strategic part. Where practitioner professions still differentiate (strategists, business operations modelers and IS engineers are quite different professions), the increasing integration in the competency methods signifies the increasing awareness for the need to align seamlessly across the strategic lifecycle.

The fact that these competency methods match with top down defined subject matter domains, we take as indication that the essential definition we used to produce the subject matter domains, portrays a valid world view.

**Foundation for researcher insights**

As the clusters of related constructs — that form around the key entities used as domain partitioning perspectives – limit contingencies, researchers can explore the causal relationships between these and infer the underlying structural causes. Defined in this way, domains become the foundation for developing grounded actionable knowledge. Research at the level of the domains proposed has been conducted quite extensively as Appendix C demonstrates with a broad overview of examples across all domains. This includes research into the fabric of a domain such as its possible dimensions and values, but also research into the kinds and diversities of artifacts and how these are assembled from the underlying fabric. For example research on cultural dimensions/values (Detert et al. 2000; Leidner and Kayworth 2006; Quinn and Rohrbaugh 1983) provides insights into existence and categorization of the elements that cultural impact models are constructed from (Steenbergen 2011). The overview in Appendix C also confirms that, in addition to practitioner competency development, independent research is possible in domains, as expected because of domain autonomy. For example, to implement a production model (Ross et al. 2011) that has been designed for the production operations domain, a practitioner with responsibility for the transformation operations domain has degrees of freedom in deciding how and in which transformation steps. This is true for research as well as demonstrated by research into types of transformation approaches such as punctuated equilibrium (Sabherwal et al. 2001), that proceeds independently of research in any other domain. What the overview in Appendix C also demonstrates is that this research is fragmented and has not been performed under a common theme of alignment. A cumulative research tradition still needs to develop.

**Managing Complexity**

Partitioning to create domains has the risk of complicating practitioner's alignment tasks, as alignment across domains is now required as well. We argue that this complexity is not created by the domain concept, rather it is a given reality in enterprises. Domains just follow structure; they don't create it. Practitioners with top management roles (Menz 2012) are used to working together to achieve coherence and composability across their domains of responsibilities.

## 4 Alignment artifacts

The amount of detailing that is required to design the organizational and administrative infrastructure in large enterprise settings, is considerable. To allow practitioners to focus on the essential alignment decisions, we introduce alignment artifacts that focus on a limited number of key behavioral properties that need to be aligned. For example, in the diversification example from Tab. 1, instead of having to fully explain the details of the individual work packages and roadmaps, it should allow the business change manager to focus on explaining how the roadmap's transition pacing is tuned to the absorptive capacity of the regional business units (Nill and Kemp 2009). Alignment artifacts organized into connected chains need to allow practitioners to assess alignment in their area of competence to adjacent areas, as well as an integral part of the overall alignment.

### 4.1 Alignment Artifact Creation Method

To reconceptualize alignment as a domain-based artifact centric operation, we build on two research lines. One is the design focused view of artifacts that stretches from the pioneering work of Simon (1996), through enterprise engineering (Dietz et al. 2013) to DSR (Niehaves and Ortbach 2016). It considers a single artifact that has an inner environment that concerns its construction and an outer environment that concerns its usage. To understand the extent to which the artifact achieves its goal (the *fit*), not the full specification of its characteristics is required; assessment based upon a limited number of externally visible attributes[8] is sufficient. The second is the strategic management view of alignment in which alignment is a composite operation across the four quadrants of the SAM (Henderson and Venkatraman 1993), connecting strategic and operational structures (Bergeron et al. 2004). Combining both, we define alignment as chains of artifacts across our domain model (contributed by the SAM view) with attribute based matching relationships between them (contributed by the single artifact view).

### 4.2 Alignment Artifact specification

In DSR, design artifacts are defined as "a general solution to a class of problems" (Baskerville et al. 2009, p.1). They are the key building blocks used for designing and constructing the artificial (Simon, 1996). In IS research their proposed scope was initially limited to IT systems — the IT operational quadrant of the SAM (Hevner et al. 2004). Later authors extended to include IS systems of software, users and use processes, but also IS-related organizational methodologies and interventions (Kuechler and Vaishnavi 2008; Orlikowski and Iacono 2001) — covering all four quadrants of the full SAM.
Where design artifacts are the detailed building blocks that practitioners use to elaborate in full the functional and construction aspects of the operational and strategic artifact designs, our domain based reconceptualization of alignment focuses on the essential behavior that is exposed across design artifacts at their external interface in the domains identified and that needs to be aligned. Examples from the diversification example in Tab. 1 include the central versus decentral capability balancing, pacing of the transformation, constraints on the delegation of partner acquisition, and targeting of

[8] Simon (1996) already observed this fact in his seminal work: "whether a particular system will achieve a particular goal or adaptation depends on only a few characteristics of the outer environment and not at all on the detail of that environment" (Simon 1996, p. 8), and as a next observation: "We might hope to be able to characterize the main properties of the system and its behavior without elaborating the detail of either the outer or inner environments" (Simon 1996, p. 9).

accelerator programs. To clearly differentiate the alignment focus from the design focus we introduce the notion of *alignment artifacts*, defining them as “envelopes of underlying design artifacts that only surface those behavioral properties that are relevant for alignment”. The set of alignment artifacts we propose is identified in Tab. 3 from the previous section. Existing research as listed in Appendix C has been used as inspiration to identify potential candidates, for example research into business models (Osterwalder and Pigneur 2010), production operating models (Ross et al. 2011), governance models (Uhl and Gollenia 2016), innovation models (Giesen et al. 2007; Mathews 2010), and culture impact models (Steenbergen 2011). Per cell in the domain matrix, a single alignment artifact is depicted. Subsequent research may find that refinements are warranted that justify additional sub-grouping of design artifacts into multiple alignment artifacts per domain cell that highlight different areas of design that require a separate alignment focus.

To differentiate their intended use, when naming artifacts, we have adopted the term *approach* for strategic alignment artifacts, and the term *model* for operational alignment artifacts. This reflects the fact that the first are often verbally formulated strategies such as an innovation strategy[9] , and the second are often models of operational entities such as a landscape view of an operating environment (Ross et al. 2011). For construction alignment artifacts we selected terms that are specific for the domain and refer to the building blocks that the operating models are constructed from: resources, work, stakeholders, attitudes and options respectively (see Tab. 3). Using these terms for the alignment artifacts does not imply that different representations are not possible in the underlying set of design artifacts. For example, using a *business model* (Osterwalder and Pigneur 2010) to describe in full a production approach instead of a textual formulation. As the focus is on the essential attributes of the set of design artifacts on their outer interface (“decentralization” of a production approach, “pacing” of a transformation model) that matter from an alignment perspective, the choice for the design representations is less relevant. What matters most are the key differentiators that can be abstracted and that are the essential ones used in attribute based alignment matching.

## 4.3 Alignment Chain specification

Alignment chains are constructed by creating relationships between alignment artifacts in domains, as depicted in Fig. 3. As defined in the Sect. 3, in

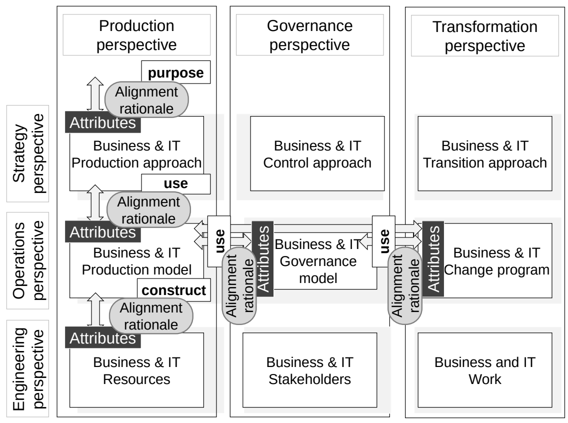


*Figure 3: Domain-based alignment conceptualization*

the vertical dimension only adjacent artifacts can have relationships, in the horizontal dimension all artifacts can be connected. No transversal relationships are envisioned. The relationships are formed through a matching that uses the attribute based behavior of the artifact in one domain in an attribution based reasoning by practitioners that explains the alignment with the artifact in the to be aligned domain. We define attributions as “the use of information to arrive at causal explanations for events”. The term derives from Attribution theory (Fiske and Taylor 1991) as developed in Social Psychology, that is concerned with how ordinary people explain the causes of behavior and events. In our usage of this concept, however,

[9] For example the Innovation strategy named *Enterprise model innovation* that is defined as “innovation [that] chang[es] our extended enterprise and network with employees, suppliers, [. . . ] including capability/asset configuration”, the innovation pattern that applies to the diversification example from Tab. 3 (Giesen et al. 2007, p.28).

it is not the receiving stakeholder but the sending practitioner that performs the attribution. It links the theory based findings from research with the reasoning by practitioners.
For the vertical relationships, the alignment rationale that explains the fit is primed on the type of perspective in the lifecycle dimension (see Fig. 3): *Purpose* focused for the strategic alignment between strategy and environment, *Usage* focused for the functional integration between operations and strategy and *Construction* focused for the construction integration between engineering and operations. For the horizontal relationships between domains the alignment reasoning is integration focused (see Sect. 3 for the terminology).

### 4.4 Alignment Chain demonstration

To demonstrate the application of alignment chains, we apply the conceptualization to the example from the Introduction of a company that is aspiring regional differentiation. Depicted in Fig. 4 are alignment chains for the business change manager (A) and the alliance manager (B).

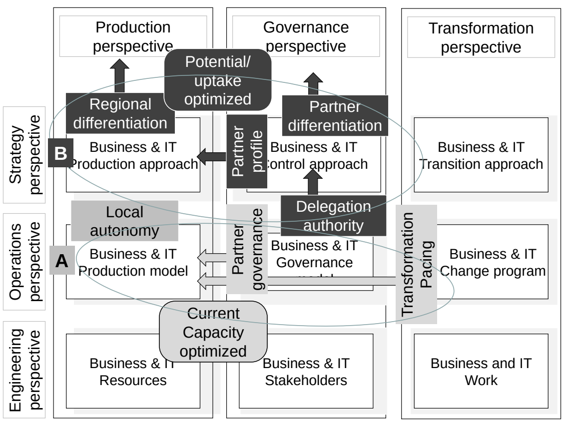


*Figure 4: Demonstration of alignment chains*

Alignment on chain A matches the pacing of the transformation that creates the local autonomy in the production and delegation of partner governance with what the current business can absorb. Increase of local production and partner management capability may for example require training or even new personnel, may require refurbishment or new facilities for customization of products and partner housing, and may require updates of IT systems to support decentral product and partner portfolios. The decision of the business change manager is to optimize the change with respect to an evolutionary growth with as much reuse as possible of existing human and IT resources and governance models, therewith tuning in to the absorptive capacity of the business units. This decision is reflected in the alignment rationale *current capacity optimized* and is explained in this way to enterprise decision makers.
Alignment on chain (B) matches the delegation authority in the governance model that grants rights to the local business units to select partners, to the regional partner strategy and makes sure that the partner profiles (for example only local partners for specific product ranges and local logistics) remain integrated with required changes in the Production domain. The decision of the alliance manager is to optimize the selection of partners with respect to an overall potential in terms of market development, revenue potential, innovation strength, balanced with the cost and risks associated with adding them to the portfolio. Based upon this the delegation will be scoped to specific segments of partners that have been profiled, with exception approval at head offices. This decision is reflected in the alignment rationale *potential/uptake optimized* and is explained in this way to enterprise decision makers.
Appendix B contains a fully elaborated example from the practice of the authors in which a global company in physical design and engineering plans for a digital transformation. Alignment attributes, dependencies and decision rationale are specified as in Fig. 3 but now across all domains in full.

## 5 Knowledge Model

Alignment knowledge needs to connect the artifact related knowledge that practitioners need, with the insights developed in research (Coltman et al. 2015; McLaren et al. 2011). Knowledge accumulation should support multiple levels of abstraction: *basic* insights into which artifacts are needed for alignment and their characteristics,

| Level | Description | Characteristics | Mechanisms | Knowledge Item |
|---|---|---|---|---|
| 1 | Basic | Ontological Theories, Domain wide | Analyzing | Domains, Constructs, Artifacts, Attributes |
| | | | Classifying | Dimensions, Classes, Taxonomies |
| 2 | Justificatory | Explanatory Theories, Domain Situated | Contextualizing | Patterns |
| | | | Engraining | Barriers |
| 3 | Foundational | Grand Theories, Unbounded | Fueling | Forces |

*Table 4: Knowledge model definition*

*justificatory* knowledge that explains reasons for differences in solutions across contexts, and *foundational* knowledge that explains the underlying forces that govern alignment (Gregor and Hevner 2013). For example, the identification of pacing as an important attribute of a transformation roadmap, the underlying causal mechanisms that favor evolutionary pacing versus revolutionary pacing in specific industry and innovation contexts and enterprise set ups (Brown 1999), and a stakeholder theory that acts as an underlying foundation that explains how vested interest use political forces to resist change.

### 5.1 Knowledge Model specification

The knowledge model as we propose it consists of three levels of increasingly more abstract knowledge with different purpose and scope. Tab. 4 provides an overview. Level 1 lays the ontological groundwork by *analyzing* what exists in the alignment design spaces and how that can be *classified*. The scope is domain wide. Level 2 extends with explanations of regularities and how these depend on context, and describes the underlying mechanisms that cause their differentiation into patterns and how these become *contextualized* and *engrained*. The scope is specific for a certain type of situations in a domain. Level 3 provides for grand theories that describe the forces that *fuel* the underlying logic found at level 2. The scope is unbounded with universal applicability.

The discretionary build-up across these three levels reflects a view of knowledge building in which situated mid-range knowledge at level 2 is derived from analysis of observations of artifact design at level 1 providing the logic to explain them, as well as confirmed by more abstract formal theories at level 3 (Kuechler and Vaishnavi 2012).

#### 5.1.1 Level 1 knowledge specification

Research at Level 1 uses knowledge producing mechanisms such as analyzing and classifying. Analyzing is used to investigate domains and their dimensions, the constructs and design artifacts that populate domains, the alignment artifacts that wrap them, the attributes used for matching, how artifacts connect in alignment chains across the lifecycle and subject matter dimensions. Classifying is used to investigate how artifacts differentiate into classes, and produce taxonomies of frequently occurring types and their key differentiators.

It defines for example for the governance domain the existence of *centralized* and *distributed* governance classes with as differentiating dimensions the *locus of control* (*headquarter* vs *regional business unit*) and the *enforcement type* (*hierarchical* vs *delegated*).

**Examples of existing level 1 research**

Other examples from Appendix C for the remaining subject matter domains include: for the "production domain", research on production models (Ross et al. 2011) and business models (Osterwalder et al. 2005) that contributes to identification of alignment artifacts; for the "transformation domain", research on type of change scopes such as *routine*, *transitional* and *foundational* (Bruls et al. 2021), and types of change frequency such as punctuated equilibrium (Sabherwal et al. 2001) that contributes to the classification of transformation models; for the "culture domain", research on

| **Context** |
|---|
| An enterprise that offers a portfolio of standardized insurance products for the commodity consumer market, has acquired another business with a portfolio of highly tailorable private banking products for the high value consumer market. The production models have different designs: operational efficiency focused with dedicated Web sites in the front office and fully automated production pipelines in the back office per insurance offering, versus customer intimacy focused with real time analysis of behavior and matching of private banking offerings in the front office, and case based handling in the back office. The CIO needs to explain to the board how (s)he will leverage these capabilities to implement a new integrated business model. |
| **CIO presentation** |
| “Through this acquisition we aim to reach out to those upmarket consumer segments that we could not reach with our insurance brands.<br>From the *production* perspective, the consolidated production model that we are migrating to, relies upon a layered construction approach. It keeps the back-office based fulfillment platforms of both our newly acquired private banking arm and of our commodity insurance arm and integrates them through a new mid office-based configuration capability (construction). This capability while retaining the investment in today’s order processing platforms is used to offer a set of composite banking and insurance offerings with a rich set of customization features (usage) that leverage new upmarket private customer segments also for our insurance arm (purpose). We have gone through several options to determine the best IT support — and decided to acquire a new client interaction platform, develop the new configuration capability in the mid office ourselves and as said will keep the existing order fulfillment systems (construction).<br>From the *innovation* perspective, we have searched the provider market and selected a client interaction platform (construction) from supplier ‘Engage’ that combines rich feature customization with a collaborative experience sharing (usage) that allows our sales staff to connect with clients in communities of interest (purpose).<br>From a *cultural* perspective, we will need a new values model for our sales staff (usage) that puts cooperation with our clients first (usage). To accommodate the rapid development of contents for these platforms, our IT personnel will need to shift their focus from long cyclic development to much more agile authoring-based development (construction).<br>From the *transformation* perspective we have decided to quickly introduce our new front office collaborative platform (usage) for our high value customers to create a new profile in the market (purpose), while rolling in the mid office capability step by step (construction). We will migrate those commodity clients with an interest in private banking or more flexibility in insurance products, at a later stage. Over time we may decide to further rationalize the IT systems (production construction) under both order fulfillment platforms (production usage) to exploit the synergies (purpose).<br>From a *governance* perspective we have decided to migrate some of the client control to local offices (usage) that can better tune in to regional aspects and differentiate the portfolio (usage).” |

*Table 5: Example of alignment attributions (identified in superscript) and domains (identified in italics).*

cultural dimensions/values (Detert et al. 2000; Leidner and Kayworth 2006; Quinn and Rohrbaugh 1983) that provides insights into existence and categorization of the elements that cultural models are constructed from, and research on cultural types and differentiators (Kappos and Rivard 2008; Sackmann 1992) that contributes to the classification of cultural models; for the “innovation domain”, research on innovation typology and terminology (Garcia and Calantone 2002; Rowley et al. 2011) that contributes to identification of constructs and innovation building blocks that populate the innovation domain, et cetera.

#### 5.1.2 Level 1 knowledge demonstration

Practitioners can use Level 1 knowledge to explain their reasoning to stakeholders and guide the implementation, using the $^{\text{construction}}$, $^{\text{usage}}$ and $^{\text{purpose}}$ attributions (see Sect. 4.3) on the alignment relationships across domains. Tab. 5 demonstrates this through an example of a CIO presenting to the board of directors, explaining how the intended merger of two enterprises with different business models will be handled.[10]

#### 5.1.3 Level 2 knowledge specification

Research at this level uses knowledge producing mechanisms such as contextualizing and engraining. Contextualizing is used to investigate the causal reasons for why specific patterns fit specific situated contexts. This requires explanatory theories that detail the causal dependencies between a pattern and the context, that can clarify the reasons for the match. Consider for example when a *centralized* governance pattern is a better match than a *distributed* or *coordinated* governance pattern. It requires the understanding which stakeholders are involved in a specific context and the powers available to them, the compliance strategies they can pursue, and the locus of control and the enforcement mechanisms that can implement these. Enforcement of compliance in a central pattern, for example, requires a central body that can set the rules that need to be followed. This is readily available in a hierarchical enterprise context. However also in a distributed pattern it is possible as the Introductory example in Tab. 1 illustrates. Responsibility for partner selection is delegated in this case to regional business units, but with a scope set centrally. If, however no central or delegated locus of control exists in a context, such as for example in an ecosystem of equal partners, then central or distributed governance patterns cannot be achieved, but other compliance mechanisms are needed: *coordinated* (an informal mechanism) or *voluntary* (e. g. commercial opportunties, ease of doing business, etc.). The attributes that differentiate between patterns are the foundation for development of Level 1 taxonomies that now can be understood not just by observing them, but by understanding the causes that produce them.

Pattern fit can be assessed in terms of the alignment rationale attributes (more effective control of business units, easier partner acquisition, dominant capture of market share, et cetera) that specify goals that relate to strategic purpose to be achieved (Bleistein and Cox 2006), or economic models of optimum scope of artifacts (Winter 2011) that can weigh investments in terms of outcome per artifact.

Engraining is used to investigate how adoption of patterns can create barriers to entry into a market. Consider for example, an information and promotion sharing pattern that has been used to build external influencer relationships, as could be a strategy adopted in the Introductory example of Tab. 1. This has created dedicated and committed communities of advocates that are loyal to the brand. These relationships and communities took considerable time to set up and foster, and are hard to mimic once a specific share of the available ones has been obtained. In this way, engrained patterns may create competitive differentiators (Besson and Rowe 2012; Porter 1985).

[10] The example focuses on attributions. Alignment rationale and attribute based matching has been demonstrated already in the inline example from Sect. 4 and in full in Appendix B. It is present in the example as well, but remains implicit. e. g. initially retaining the investment in today’s order processing platforms, with potentially at a later stage harvesting synergies, performs cost/benefit optimization across solutions.

**Examples of existing level 2 research**

Additional examples from Appendix C include: research on IT governance mechanisms and strategic alignment (Wu et al. 2015) provides insights into explaining how governance approaches affect organizational performance; research on mechanisms engendering interpersonal trust provides insights into how to engender trust in online communication (Gregor 2009) —- used in community building and information brokering production models; research into mechanisms of compliance models (Foorthuis and Bos 2011; Weaver et al. 1999) provides insights into how these match specific contexts; research on generative mechanisms that drive the development of digital infrastructure (Henfridsson and Bygstad 2013) provides insights into the kinds of digital platforms and how they fit context, et cetera.

**Creating actionable guidance**

Level 2 causal insights created in this way, can be reformulated as prescriptive or guiding rules, that relate characteristics of artifact construction and behavior to characteristics of context and to outcome — thereby linking construction, usage and purpose across alignment lifecycle phases. For example: "for effective control (purpose) adopt a delegated governance model (construction) in case of regional differentiation (usage) ". In the extant literature (Aken 2004; Gregor et al. 2020) these formulations are referred to in various ways dependent on the exact scope: as design principles (construction focused only), operational rules (including artifact behavior in the context of use), or technological rules (solution oriented knowledge in management research). Level 2 knowledge therewith both delivers causal insights as well as means-end oriented guidance (Bucher and Winter 2008). These "two sides of the same coin" are well known in both practice and research (Gregor 2009). Practitioner methods translate experience and reasoned understanding into "how to" guidance on artifacts and their relationships (Brinkkemper et al. 1999). Research has described this same process of turning explanatory knowledge based upon observations into prescriptive design knowledge (Gregor 2009).

### 5.1.4 Level 2 knowledge demonstration

Tab. 6 illustrates how level 2 knowledge equips practitioners with the underlying logic to understand why specific designs better match specific situations.

It consists of an extension of the CIO presentation from the example in Tab. 5, in which the CIO now underpins his/her reasoning with results from the knowledge model — using examples of facts that could be uncovered by future applied business-IT alignment research. Note that the table, while adopting a practitioner perspective, can be read from the researcher perspective as well as an illustration of how to offer actionable guidance to practitioners.

### 5.1.5 Level 3 knowledge specification

Research at level 3 uses knowledge producing mechanisms that uncover the underlying forces that are foundational to a domain, and that investigates how these fuel the pattern and barrier creating logic at Level 2. Level 3 knowledge goes beyond insights and predictions —- rather it defines the paradigm that underlies knowledge in the various domains. It allows practitioners to achieve deep understanding of their domain and extract long term competitive advantage. The types of theories that we are addressing here have been identified as grand theories with "sweeping generalizations, relatively unbounded in space and time" (Gregor 2006, p.616), that frequently originate outside of the IS discipline from the natural or social sciences. For example, stakeholder theory (Freeman 2010) that, applied to the governance domain, explains how specific governance patterns are engrained through a web of power/influencer relationships. The forces that shape this web are of a *political* nature. Using political tactics, motivated by the objectives of the group or party they represent, stakeholders will build alliances, will thwart adversaries, and will exploit and lobby for organizational controls and measures that match their best interests. These *political* forces are the

| CIO presentation – continued |
|---|
| "On the next slide we have summarized the external evidence that underpins our choices. Layered production models have been identified in various taxonomies developed in applied alignment research. Quest [2032]'s hierarchy of production models for example classifies them from a complexity perspective as high to very high and indicates that they are well suited to support a production approach aimed at operational excellence yet with the possibility to differentiate the product portfolio. Successful implementations have been found to correlate with the maturity of the IT organization performing (proven track record, well defined practitioner competency, integrated partnerships, etc). We meet these requirements.<br>From a transformation perspective, Dive et et al. [2028] have considered cases in consumer-oriented companies and found a correlation between the transformation focus (outside in) and the degree to which expected transformation benefits were realized. They conclude that outside in transformation styles are the preferred approach especially when higher value consumer segments are addressed — as the impact on the customers is directly visible and offerings can be tuned and adapted to initial experiences. They further conclude that regional business control over the customization of offerings is beneficial.<br>Winner et al. [2028], in developing a foundational view of the future enterprise in a collaborative society, claim those companies will be able to acquire competitive advantage, who successfully integrate the continuous development of employee social skills, of niche partner networks, and of a resource base that can be configured under mass diversification.<br>We believe that following this direction we can leverage our existing production capability while blending in our newly acquired up market selling capabilities and our newly developed collaborative set of values into a unique mix that differentiates us in the market and positions us well for next steps to become the world's leading provider of the financial experience". |

*Table 6: Examples of research results supporting alignment attributions*

source from which the causal logic arises that produces governance patterns at level 2, such as *centralized* governance that is reinforced by the political maneuvers of single business owners that drive the *hierarchical* enforcement, or *voluntary* governance that is reinforced by those of multiple business owners that drive the *coordinated* behavior.

### 5.1.6 Level 3 knowledge demonstration

We theorize that in every domain such a foundational theory could be developed. We see the following as options for the other domains (see Appendix C as well):

**Resource based theories** rooted in the Engineering science for the Production domain (Wernerfelt 1984). On the one hand, industry wide *engineering* forces favor specific solution patterns that through the shared adoption of resources at the level of the industry are affordable to all. For example, the emergence of business and social platforms due to availability of ubiquitous connectivity and access devices has produced mainstream solution patterns for social community building. On the other hand, investment at the enterprise level for solution customization or for dedicated development/extension, need to consider the *engineering* forces that shape the overall portfolio and can exploit the overall resource base best.

**Norm and Attitude based theories** rooted in the Social sciences for the Culture domain (Leidner and Kayworth 2006). The behavior in an organization is the result of *social forces* that derive norms and attitudes from an entrepreneurial or societal vision. These foster specific cultural patterns, with differentiating dimensions and characteristics. For example, an incentive-focused sales culture that is driven by an entrepreneurial vision of *reward the best*, versus a collaborative experience-focused culture driven by a societal vision of an *open society based on sharing*.

**Work based theories** rooted in the Economic sciences for the Transformation domain (Uhl and Gollenia 2016). The *economic* forces through which specific combinations of scope and change of a transformation are preferred, foster the adoption of specific transformation patterns. For example, a strategy of regional differentiation may be confronted with the choice between full new regional production units versus adaptation of existing ones. The economics of the transformation of the selected scenario may favor a revolutionary one for the first (less expensive and better outputs for a single big launch) and a more evolutionary one for the second (better spread of costs and benefits for a phased introduction).

**Knowledge based theories** rooted in the Psychological sciences for the Innovation domain (Grant 1996). The innovation profile of an enterprise is the result of *psychological* forces that shape the thinking about innovation and influence the knowledge acquisition and adoption patterns that determine the reach of innovations that are possible. For example, a *follower* of proven trends avoids strategic risk taking and only selects tried and proven innovations that are carefully assessed in selected business units, while a *digital front runner* is a first mover when it comes to digital innovations and assigns corporate wide responsibility for finding them to every employee.

## 6 Evaluation

We evaluate our objectives and their operationalization through the three proposed artifacts and compare our approach to and integrate it with both existing approaches.

### 6.1 Evaluating objectives

**For practitioners:** The objective of the shift we propose for practitioners, requires effective and efficient use of artifact based reasoning and research results. This is supported by the following evidence:

- The CIO presentation in Tab. 5 demonstrates how the attributions on relationships between artifacts allow for concise and focused language that is natural to enterprise decision makers, and allows them to focus on the essentials of alignment. The extension in Tab. 6 demonstrates how actionable knowledge that underpins the alignment decisions can be derived from artifact centered research.
- The full elaboration of the alignment chains for an enterprise in Appendix¸B demonstrates effectiveness of a full case of alignment matching from practice. The model is comprehensive and essential alignment decisions indeed can be limited to a handful of attributes.
- The evaluation by the expert panel in Appendix D of the practitioner perspective confirms the relevance, through comments such as: the “focus on causality and coarse grained view is preferred to detailed prescriptive guidance in architecture methods”, “domains are manageable chunks that contain the right contents”, “this was what EA was meant to achieve”, etc. However, it also emphasizes the need to translate it into a method for practitioners, and the need for simplified presentations, through comments such as: “users will need training”, “a metamodel, very abstract”, “difficult to apply”, “translation into practice needs work”, “would use it as a tool not as a communication vehicle”, etc. See Discussion section on follow on work.

**For researchers:** The objective of the shift we propose for researchers, requires them to be able to better ground and better organize research, and provide actionable knowledge. This is supported by the following evidence:

- Inline examples from Sect. 5 demonstrate how better grounded theories can be developed. Causes and effects of artifact related phenomena can be assessed and foundational views are supported.
- The CIO presentation from Tab. 6 demonstrates how researchers can represent knowledge in actionable form.
- Appendix C demonstrates that research is being conducted across all levels of the knowledge model, scoped to domain and artifact centric questions.
- The fact that the domains we propose match established practitioner competencies implies that cohesiveness and uncoupling of domains

that is required for separate research fields to develop is present.

- The evaluation by the expert panel in Appendix¸D confirms the effectiveness of the new conceptualization for researchers, through comments such as: "actionability drives translating strategy into operations", "current research is not in useful format; the knowledge model would fix that", "actionable findings for practitioners is a broader design science topic — really interesting", "clear theoretical foundation", etc.

## 6.2 Evaluating operationalization

The operationalization of our proposed approach through the three artifacts (domain model, artifact chains, knowledge model) is grounded in multiple ways (Goldkuhl 2004). *Empirically*, through the examples of artifact chains from the full case from practice in Appendix A and the mapping of current research into the Knowledge model in Appendix C. *Theoretically*, by the use of analogies to and integration of previous research lines. The domain creation model is based on a similar model used to partition an EA space, alignment artifacts combine single artifact-based with SAM-based alignment, and the knowledge model builds on DSR and IS models of theories. *Internally* by rooting the research approach in DSR, evaluating against criteria proposed (Prat et al. 2015) and inheriting its rigor.

The examples that we present, inline and in Appendices B and C, provide for a validation that is well in line with the "proof of concept" that Gregor and Hevner (2013, p.351) find to be sufficient for very novel artifacts. Other evidence such as the logical reasoning that builds on the problem analysis of existing research, the examples of alignment reasoning in Tab. 5 and Tab. 6 and the feedback from experts on the proposed artifacts in Appendix D fall well in line with the "reasoning, proof of concept, proof of value added, or proof of acceptance and use" that G. B. Davis (2005, p.18) recommends for design artifacts.

However, as the operationalization through the three artifacts covers a scope that is so large, detailing them will require a considerable set of experiences for full validation and further theory development, for example to confirm domains and the levels in the knowledge model. We do argue that for a research field, that is in need of a new direction (Coltman et al. 2015; McLaren et al. 2011) and is receiving less attention (Gajardo and La Paz 2021), it is particularly the objective that we aspire to achieve with the proposed shift in approach (that answers the question asked in the paper's title: "where should we go") and the reasoning that justifies this that matters, and that this is sufficiently supported through the evidence we present.

## 6.3 Comparing to and integrating with existing approaches

Fig. 5 compares our domain-based approach to alignment with the SAM-based approach (Henderson and Venkatraman 1993) and the EA-based approach (Lankhorst 2012). SAM-based alignment (left in Fig. 5) conceptualizes alignment holistically across four quadrants as a single fit measure, using statistical analysis to quantify the contribution of selected parameters (Coltman et al. 2015). EA-based alignment (right in Fig. 5) covers in full the chain from business goals to infrastructure resources (Gregor and Martin 2007; Lankhorst 2012; Rouhani et al. 2015), but using detailed models that carry a lot of construction detail (Bleistein and Cox 2006; Lankhorst 2012). Our domain-based approach (shown in the middle of Fig. 5) takes the middle ground with coarse-grained artifacts and matching that focus on the essential behavior that is relevant for alignment. With respect to the SAM-based view, it shares the focus on specific behavioral aspects (determinants SAM-based and attributes domain-based) but now organized into domains with a coherency that allows better grounded theory development and traceable to design artifacts. With respect to the EA-based view it shares an artifact focus but sufficiently coarse-grained and focused on behavior that is essential for alignment only. This positioning can be interpreted as bridging between

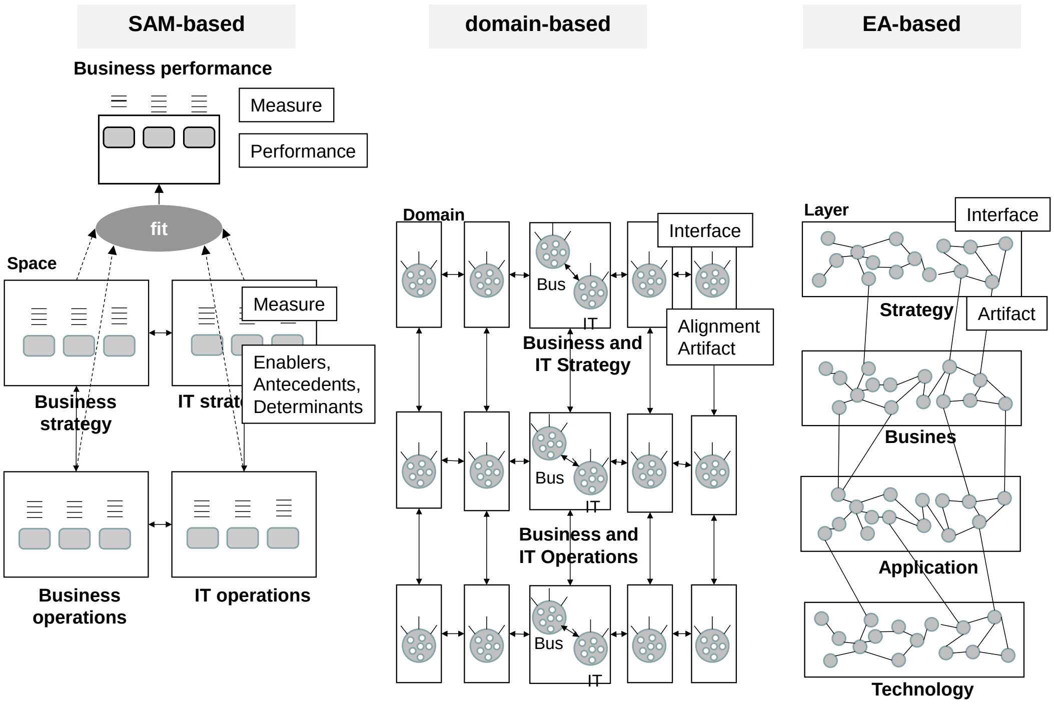


*Figure 5: Comparison with existing approaches*

these two adjacent approaches: it opens up the design under the SAM-based approach and leaves the detailed construction and dependency tracing to the practitioner methods.

Key differences include the quantification of the SAM-based approach, and the construction detail of the engineering view. Elaborations that remediate this through extension or through integration are possible.

**Extending our approach** with quantification, requires adding an outcome model that can quantify costs and benefits and the impact on enterprise performance across the alignment chains. There are several options for achieving this. The complex adaptive systems perspective (Merali and McKelvey 2006; Onik et al. 2017) addresses quantification through an exhaustive bottom up approach: starting at the artifact level, calculating the full set of possible alignments chains, assessing outcome for every chain, and then using outcome models that weigh costs and benefits. This is quite monumental, but options can be restricted to the most attractive ones — as is usually the case in for example strategy consulting. If partial views are acceptable, then, economic models of optimum scope of artifacts (Winter 2011) can weigh investments in terms of outcome per artifact.

**Integrating with a SAM-based approach** can be achieved by using an intermediate layer of decomposition of the SAM model that can be matched to the domain level of the domain-based approach. This matches SAM determinants with the alignment attributes. For example in domain-based alignment research, one could theorize through case research at artifact level about the fit between a centralized or decentralized governance model and the business model based upon cases, and then quantify the contribution of a fit within this reduced scope to an overall measure for performance across samples. The holistic macroscopic approach might take the opposite route: decompose a quantified measure into sub-parts and establish in case research if the determinants used are the most significant. Consider for example, how Queiroz et al. (2020) zoom in onto the production domain by analyzing the impact of business unit specific process digitization on overall alignment between corporate and business unit strategy and quantify this specific impact.

**Integrating with an EA-based approach:** To add additional specification and construction detail (as in the EA-based approach), an integrating approach is an obvious solution. It requires detailing of the coarse-grained alignment artifacts and alignment relationships, using established EA-based techniques that allow to create design knowledge at a fine-grained scale (Lankhorst 2012). See for example how coarse-grained alignment artifacts such as the Business canvas model and the Business motivation model can be modeled in detail in an architecture description standard such as ArchiMate (Bhattacharya 2017; Meertens et al. 2012). Instead of using such a generic descriptive language, use of a situated method that focuses on the specific context that the alignment addresses, can provide better resolution. Consider for example the situated method developed by Pijpers et al. (2012) that addresses ecosystem integration, as an option to detail construction of the alignment solution proposed in the Introductory example from Tab. 1 that addresses diversification by using regional ecosystems of partners.

## 7 Discussion

We discuss potential weaknesses, future work and impact on research and practice, and position BITA as a case for developing insights on theorizing in the broader IS.

### 7.1 Potential weaknesses

Potential weaknesses include stability of the three artifact definitions we propose, the complexity of the full set of concepts, and our focus on alignment of enterprise structure versus alignment as a process.

**Stability of artifacts:** To be able to produce a coherent body of knowledge, domains and alignment artifacts as introduced in this paper need to be well defined and stable. (Re)defining domains and artifacts repeatedly poses the same risk to our newly proposed conceptualization as the holistic measure of the SAM-based approach that kept being revisited (Coltman et al. 2015) – see Appendix A. As explained in Sect. 3.1, both existing approaches do offer many suggestions for domain identities, but lack a top down integrating view. For this purpose, we use an essential definition of an enterprise from which we identified the five domains we propose. We derive confidence from the fact that established practitioner competencies match the domains we define, and that the examples we provided and the case from practice could be covered. There is, however, no guarantee that subsequent research will not keep challenging the proposed set of domains and artifacts, and that an agreed upon set will be achieved. The question why exactly this set of domains was selected, was raised already a number of times in Expert interviews and will undoubtedly be challenged in further research. Finance was identified a number of times (also by the CDO in reviewing the case in Appendix B) as a high potential candidate. In artifact centric research, experiences are available of research areas that agree on a standard set of concepts and jointly use and develop them. For example construction languages such as UML (UML 2023) and ArchiMate (Lankhorst 2012), and an artifact such as the business model canvas (Osterwalder and Pigneur 2010) have achieved stability and gained acceptance with large communities of practitioners. It does require considerable attention from the researcher and practitioner community as a whole and a concerted way of working — see the Sect. 7.2.

**Complexity of the full set of concepts:** complexity poses another risk, as emphasized a number of times in the expert interviews as well. It can be quite overwhelming to have to perform alignment across 15 cells, conversing with practitioners from many different competencies and absorbing theories from many different research fields as back ground knowledge. It runs the risk of devising a “theory of everything” as one of the initial reviewers of this paper described this risk. From researchers, it will require discipline and a continuous drive for simplicity to realize a consistent and useful set of operationalizations. From practitioners, it will require the discipline to balance oversight with detail to achieve the right level of decision making. But as we argued already in this paper, we do not create complexity, we just follow it – and practitioners are used to working in such an arena.

**Scope focus:** A third potential weakness is one of focus. We have addressed in this paper primary artifacts that create enterprise structure. This deemphasizes the secondary dynamic capabilities (Teece et al. 1997) that address the alignment process such as environment sensing, assessing value of new technologies, partnering between business and IT, et cetera. These have been targeted in later SAM-based alignment research (Chan and Reich 2007), sometimes almost exclusively (e. g. Luftman et al., 2015). In our approach, they can be included in the domains proposed in this paper – for example the innovation domain will include environmental sensing, and the governance domain partnering between stakeholders. To maintain a focus on such cross-domain aspects (like financial aspects as well), an extension that might be considered is to create a cross-sectional view that selects these secondary aspects and bundles them, without losing domain cohesiveness.

## 7.2 Further Work

Follow-on iterations are required of the design of the three proposed artifacts. For domains, important topics include assessment of completeness and correctness, and if extensions are required. This requires validation based on additional application in cases like the one in Appendix B. For alignment artifacts, further work is required that sketches out in more detail the set identified. This will benefit from building on research findings as in Appendix C on for example domain dimensions, key artifact attributes, and artifact representations. The deepening that is required for the knowledge model is not per se specific for BITA research, but applies more generic to DSR (see Sect. 7.3).

**Integrating research approaches:** As for alignment the behavior of the designed artifact in its context of use is crucially important, BITA research is primed on descriptive/observational research and needs to integrate this with design research to connect with artifact construction (Baskerville and Pries-Heje 2010; Grover et al. 2008; Kuechler and Vaishnavi 2012; Niehaves and Ortbach 2016). Adding quantification to the integration of descriptive and design research, puts BITA at the intersection of three research paradigms: qualitative case research, design research and quantitative research (see Sect. 7.3).

**Comments from the expert interviews:** Some notable comments from the expert interviews should be taken into account during further design work. *Actionability*, as two experts emphasized, needs to be the driving criterion for knowledge production and therewith a key determinant of successful BITA research. How actionable outputs are best represented is a separate question (from causal insights and heuristics for highly skilled alignment practitioners as a rationale for their judgments, to more prescriptive guidance for engineers – as one of the experts sketched a relevant spectrum). This fits in with findings from the expert interviews and from the workshop with the CDO in Appendix B that emphasize the required focus on practitioner methods and effective representations that can be used particularly in discussions with enterprise decision makers. And finally as one expert expressed it: "it is not just about analytical alignments relationships — the social aspects that stakeholders bring to the table require an institutional view as well". This requires understanding what the contribution is of non-rational acts that come from the social world of normatively regulated social relations (Habermas 1985). These are difficult to ignore in a hype sensitive industry where complex decision making with many stakeholders, and rapidly changing contexts create a dynamic fluid mix, that require a focus on psychological and social aspects as well (Schlosser et al. 2012).

### 7.3 BITA as case for broader theorizing research

The many perspectives that come together in BITA research, make BITA theorizing an excellent case study that allows to acquire new insights into the nature and structure of theorizing in the broader IS field and beyond.

**Layering of artificial reality:** To understand foundational questions on the layering of the artificial reality, the causal mechanisms (Gregor 2006; Lee and Baskerville 2003) that produce artifact related regularities, and the different levels at which these operate provide a fruitful ground for developing additional insights. The levels and the terminology that we have used in our knowledge model are indicative of a way forward. The knowledge *production mechanisms* proposed at level 2 (see Tab. 4) are comparable to the *generative mechanisms* that are proposed by critical realism. See for example how Henfridsson and Bygstad (2013) rely on the paradigm of critical realism to identify generative mechanisms that drive the development of digital infrastructure, and how Zachariadis et al. (2013)) use the layering of critical realism to integrate quantitative and qualitative research at Level 2 of our knowledge model. The drivers that we have identified at level 3 as *Forces*, a term we borrowed from the natural sciences, illustrate how at the deepest level causes exist that can contribute to quite different types of patterns at level 2.

**Stability of artifacts:** Another example of the potential of using BITA theory as a case for broader findings, is the debate that differentiates between how theories in strategic management research are perceived as foundational constructs (such as the BITA fit construct) that are either fluid, amorphous and formed by each of their individual constituents with every determinant added acting as a new formative element that results in a different construct, or with internal coherence, well defined and with clearly identifiable properties, with every new attribute acting as reflective element that considers a different property of the same construct (Bagozzi 2011; Petter et al. 2007; Weber 2021). Our BITA theorizing suggests that a possible arbitrator here may be the coherency of domains and the design artifacts that populate these. Attributes identified as the key behavioral properties depend on context, but the artifacts that they refer to remain the same and acquire their stability from the underlying nomological webs of constructs from which they are composed. e. g. the *pacing* of the transformation roadmap in the case of the diversification example that builds on existing organization units, versus *synergy focused* in the case of Appendix B that exploits a new organization with benefits shared between old and new, but both refer to the same underlying artifact (the *transformation model*). The behavioral properties are reflective and emanate from the design that governs the composition of the artifacts, with a domain as scope.

**Qualitative vs quantitative integration:** A third example is the integration of qualitative and quantitative research that has been recommended and discussed by many authors in the organizational science (Shah and Corley 2006) and IS (Burton-Jones and Lee 2017; Venkatesh et al. 2013). The experts in our interviews also stressed the need for quantification in our artifact focused alignment research. The introduction of design science as performed for BITA in this paper, can intermediate here by integrating at the attribute level between these three research approaches. Where business performance has been labeled as too aggregate (Piccoli and Ives 2005), measures that assess alignment of attributes at domain level may be the missing quantification link that connects engineering and functionalism. With the attributions from the CIO example in Tab. 5 adding an interpretive layer of reasoning and rationale (Shah and Corley 2006).

### 7.4 Impact on Research and Practice

We summarize the impact of a domain based-artifact centric conceptualization of alignment on research and practice.

**Agreeing description standards:** To produce cumulative alignment knowledge in actionable form, as a first step research and practice need to agree jointly on domains, the typology of artifacts, and the types of knowledge that support reasoning across them. Compare this to the standardization of knowledge in software engineering (SWEBOK 2023) and of artifacts in the MIS industry through languages such as UML (UML 2023) and ArchiMate (Lankhorst 2012).

**Access to experiences:** Next, developing a knowledge base requires access to a substantial set of experiences. Developing this through individual case studies will provide first insights, for example in the way that Ross et al. (2011) studied production models. However, building a full experience base of artifact alignment patterns that are sensitive to industry context is a monumental task. Consider, for example, the library for a *business component model* — a single artifact from the business operations space — that has been developed in the services industry. It contains more than 300 instantiations across the different industries (Flaxer et al. 2005). The scale of experimental data required is so large that new innovative ways of acquiring data are needed through cooperation of industry and research (Buhl et al. 2012; Ward 2012)). An example is the approach introduced by (Osterwalder and Pigneur 2010) in which online meeting places for exchanging experiences are established — that research partners can gather around.

**Research scope and approach:** Different types of research communities will be required to further develop the alignment field according to our proposed approach. As the core representation is a conceptual model of alignment artifacts connected through semantic relationships, a community of researchers with an interest in semantic modelling is essential. The fact that it is domain based, implies that researchers preferably should scope their research to a specific domain. This requires strong ties to both practitioners and researchers with knowledge of and interest in the domain's subject matter.

The approach to researching knowledge depends on the position in the knowledge model. The ontological nature of layer 1 knowledge requires participation of researchers with an interest in ontological analysis of a design space and classifications of its inhabitants. The explanatory knowledge at the Level 2 requires researchers with an interest in exploring explanatory theories of underlying regularities, that can produce libraries of patterns. Particularly at this level integrated research approaches that combine case based design research with quantitative research would be able to ground findings on substantial empirical evidence. The foundational theories at the Level 3 have an unbounded scope and would be drawn from a broader research community. They rely on logic based reasoning and heuristics approaches to find candidate theories.

**Translation into practice:** As expert interviews highlighted, the approach needs translation before practitioners will be able to effectively use it. Developing it into a full method that equips practitioners with a set of procedures to follow and presentation techniques to use is an important topic. As already described in Sect. 5, practitioners will use the results of the knowledge from the various levels in different ways. An available artifact taxonomy can offer options that can be considered, when creating an artifact instantiation. Knowledge on artifact behavior in a specific context can guide and help to validate choices for a specific model in a context. Foundational theories can be used as background knowledge, etcetera.

The framework of artifacts itself that we presented in this paper does not yet provide for this guidance. It will, however, already guide practitioners in how to think about and structure alignment questions: "use domains to break the puzzle into pieces", "use essential characteristics when assessing the alignment", etcetera.

## 8 Conclusion

Practitioners in their day to day activities take informed alignment decisions and explain these based upon reasoned insight – to a shareholder, to the board, etc. We have argued in this paper that they need *actionable* knowledge connected to the artifacts that they work with in their area of competence, knowledge that both existing approaches cannot provide. As a way forward, we have proposed a new re-conceptualization that centers on the artifacts that practitioners work with in their area of competence.

**Contribution to research and practice:** we consider as the main contribution of our paper the approach that answers the "where to go" question. The domain based artifact centric reconceptualization allows researchers to produce and practitioners to use actionable knowledge related to the artifacts they work with.

Secondly, the operationalization that we propose introduces three separate artifacts that open detailed follow on research fields. Domains create coherent areas of subject matter for competence development and scientific inquiry. Analysis at this level provides an ontological view of the design space they cover, that feeds the definitional level of the knowledge model. They are a starting point, a substrate, for scientific inquiry and development of practitioner competence. Alignment artifact chains allow practitioners to reason about alignment at a sufficiently abstracted level. The attributions we propose provide a language that is natural to decision makers. The knowledge model allows researchers to develop theory based explanations that support practitioner alignment rationale, and grounds academic research in practice (Urquhart et al. 2010). It allows practitioners to understand the artifact alignment options available for their area of competence, how these differentiate and can be matched, and trace the rationale for their choices to research results. The three levels proposed and their prescribed contents projected on top of the domains provides a structured foundation for cumulative knowledge building, that was lacking until now. For practitioners the operationalization can be developed into a method.

**Evidence:** The evidence we presented (the case from practice, expert interviews, and mappings of existing literature to the knowledge model) illustrates the usefulness of our proposed approach. Follow on research will be required to validate and refine the theoretical underpinnings (the domain identity, knowledge representation, integrated research approaches) and to translate it into a format that will appeal to practitioners (from an abstracted model to the natural language they use in explanations).

**Native IS theories:** Our approach is in line with calls for native IS theory development that takes the artifact as the basic substrate for developing native IS theories and on informing practitioners with actionable research results (Benbasat and Zmud 2003; Gill and Bhattacherjee 2009; Orlikowski and Iacono 2001; Straub 2012). It emphasizes to a lesser extent the divide between business and IT, and balances all subject matter perspectives (production, transformation, governance, innovation and culture) that in an increasingly volatile and transformative world matter. And it illustrates how useful BITA is as a case to gain insight into the nature and structure of IS theories and beyond.

**The future:** More perhaps than in any other area of IS research the results are promising, as the alignment question is a fundamental question that underpins the success or failure of usage of IS in enterprises and institutions worldwide. In the enterprise world populated with artifacts that connect real outcomes with real costs of assets, reasoned insight into the connection logic will help to improve strategic decision taking. Bringing this closer to reality is the ultimate payoff of a research focus that takes the practitioner's view as a primary lens.

## A Appendix – Related Work

In this Appendix we discuss in more detail related work for both existing approaches. We consider the conceptual foundations and analyze the issues that arise for practitioner focused alignment knowledge.

### A.1 Alignment from the strategic management perspective

Inspired by the principles of strategic management research (Furrer et al. 2008; Kuechler and Vaishnavi 2008; Venkatraman 1989), the strategic management approach defines alignment as a holistic construct that is assessed across the four quadrant SAM, and is focused on macroscopic behavior and impact on performance.

**Quantitative approach:** The different fit models introduced by (Venkatraman 1989) such as moderation, mediation, matching, gestalts, profile deviation, and co-variation (Chan and Reich 2007; Coltman et al. 2015; Luftman et al. 2015), encouraged measures that are evaluated using quantitative research (Strong and Volkoff 2005). Alignment researchers then started to use data gathering techniques such as questionnaires on enterprise business and IT strategy and structure (e. g. on alignment of plans, and capabilities), and externally available measures of for example organizational structure (e. g. on degree of centralization and complexity) and enterprise outputs (e,g, return on assets), (Gerow et al. 2014). Based on these data, statistical techniques such as structured equation modeling and cluster analysis are used to assess the influence of determinants, antecedents and enablers on the alignment measure, and to discover if patterns of low and high alignment correlate with output parameters such as business performance (Bergeron et al. 2004; Cragg et al. 2002; Kearns and Lederer 2000; Peppard and Ward 1999; Sabherwal and Jeyaraj 2015). Luftman et al. (2015), for example, use an extensive dataset acquired across 3000 enterprises to demonstrate that alignment on the determinants they use "explains 15% of the company performance". Observations like this illustrate the significant impact of alignment, and there is general agreement that it contributes to enterprise performance.

**Actionable guidance:** Detailed knowledge, however, on the underlying structural causes and relationships between the highly contextualized artifacts that practitioners use, remains deeply hidden in the generic statistical associations, blurred by the contingencies included in the broad scope of subject matter and contexts covered (Campbell et al. 2005; McLaren et al. 2011; Schryen 2013).This "blurring" makes it difficult to produce theories that address underlying causes — holistic research has been called "atheoretic" therefore (Chan and Reich 2007). In addition, relationships that are derived using statistical correlation and modelling techniques can only test a limited internal structure to produce significant findings (Hair et al. 2009). The subject matter that practitioners work with is diverse and the relation between enterprise structures layered and complex (Bergeron et al. 2004; Furrer et al. 2008; Steenbergen and Brinkkemper 2010). Therefore, alignment research that rests on this quantitative research approach and these data analysis techniques does not lend itself to produce the detailed actionable guidance on alignment artifacts that practitioners work with (Campbell et al. 2005; McLaren et al. 2011; Schryen 2013; Vaujany 2008). IS theories that center on the artifact remain hidden in the generic associations of (alignment) research with its macro focus and are not subject of follow-on research by itself (Markus and Saunders 2007). To understand for example, which organizational barriers may impede transitioning from centralized to decentralized governance (as is required in the example from Tab. 1 in Sect. 1), it is not sufficient to assess statistical associations of outcome with determinants such as *number of organizational levels*, *communication channels with business units*, *extent of hierarchical control exercised*, et cetera. It requires a research focus that zooms in into the domain of governance to resolve causes and effect relationships. For example, the fact that vested stakeholder interests through webs of power/influencer relationships create entrenchment in the current centralized set up that results in inertia (Besson and Rowe 2012) that needs to be overcome when diversifying regionally, and that stakeholder theory (Freeman 2010) therewith becomes a foundational theory for organizational alignment.

**Artifact focus:** Besides of the limited ability to explore causal contextualized relationships, measurement of alignment as a holistic concept has proven difficult to operationalize. The alignment construct (fit, moderation, congruence, etc), the alignment process (separate planning, fusion, business or IT led) and the way alignment is measured (determinants, antecedents and enablers) have been redefined repeatedly (Coltman et al.

2015; Tanriverdi et al. 2010), which makes it difficult to compare results (Coltman et al. 2015), and develop a body of cumulative knowledge. Therefore, Coltman et al. (2015, p.94) in a review of 25 years of alignment conceptualizations and measurements conclude that ".. a cumulative research tradition that spans the entire body of work on strategic IT alignment may, therefore, be elusive until such time as a more commonly accepted measure emerges or a way is found to reconcile the various indirect measures that crisscross the current literature." We see a broader parallel with the state of MIS research as a whole – as portrayed in a debate more than a decade ago, that advocated a renewed focus on developing native IS theories that focus on phenomena intimately associated with IT-based systems (Benbasat and Zmud 2003; Markus and Saunders 2007; Orlikowski and Iacono 2001; Straub 2012), and on informing practitioners as a key audience of research (Gill and Bhattacherjee 2009), versus research with a larger macro focus (Agarwal and Lucas Jr 2005).

### A.2 Alignment from the engineering perspective

In engineering of IS systems, models have been used to detail the structure of an information system. Initially research efforts focused on specific parts of an IS, such as creation of descriptive languages for the architecture of the technology (Youngs et al. 1999) and the business operating layer (McDavid 1999), or the design of the application layer (UML 2023). Many research efforts have addressed subsequently integration with the strategic layers, both bottom up from the operational part, such as the linkage between an enterprise portfolio of components processes or services and its strategic goals (Amyot et al. 2022; Arsanjani et al. 2008; Levi and Arsanjani 2002), top down from the strategic part, such as the linkage between value proposition, business operations and technology resources (Osterwalder et al. 2005), as well as using intermediate layers such as capability models (CaaS 2023; Sandkuhl and Stirna 2018).

With its roots in engineering and integrated modelling across layers, enterprise architecture (EA) aims for full elaboration to guide overall enterprise design and construction (Lankhorst 2012) and manage overall coherence (Proper et al. 2017). For its enterprise level view and the overall integration across layers with strategy, EA has been positioned as a tool to translate strategy into action and to perform business-IT alignment (Gregor and Martin 2007; Jonkers et al. 2006; Kaidalova et al. 2017; Ross et al. 2011; Rouhani et al. 2015; Saat et al. 2011). The integrated models used in EA trace construction dependencies and functional purpose across layers and fully cover the chain from strategic goals to infrastructure resources (Aier and Winter 2009; Bleistein and Cox 2006; Kaidalova et al. 2017; Khademhosseinieh and Seigerroth 2011; Lankhorst 2012; Winter 2011). ArchiMate for example, the descriptive language adopted by TOGAF (Jonkers et al. 2009) identifies five separate layers (Strategy, Business, Application, Technology, Physical).

All approaches that originate in these engineering related research efforts, as they aim to guide construction as one of their key objectives[11] , are highly detailed. This overabundance of detail hides essential alignment aspects, that drown in this detail. In addition, they are method focused (the *how to*) and lack a contents focus (the *what*) that can produce a body of subject matter related alignment knowledge (such as design space dimensions, artifact differentiators, taxonomies of artifact patterns, causal explanations for contextual matches, etc). As their focus is largely on the production and transformation domain (Jonkers et al. 2009) they also lack an overall view of the alignment space.

**Additional aspects**

A number of other aspects have surfaced in the IS engineering field that we consider important for our approach to alignment, but isolated and not

[11] See for example the best practices that Foorthuis and Brinkkemper (2008) derive for projects to conform with EA guidance.

integrated into an overall alignment conceptualization. Examples include:

- Separate competency methods have developed for those domains that are not covered by the EA method, that are also model based and construction driven. For example MSP (MSP 2023) that supports the transformation domain, that creates an outcome driven roadmap out of detailed work packages managing the change; and COBIT (COBIT 2013) that supports the governance domain by constructing stakeholder maps that assign roles and responsibilities. Like EA these are method focused, highly detailed, focused on full elaboration, and do not develop structured contents that can feed a knowledge model. They do match, however, domains as we identify them.
- Principles such as "focus on essentials" and "produce actionable knowledge" that underlie our reconceptualization of alignment have surfaced in engineering research, such as the discipline of enterprise engineering that focuses on essentials of construction (Dietz et al. 2013), and the concept of an actionable business architecture (Harishankar and Daley 2011). We have built on these in our conceptualization that focuses on essentials as well.
- Approaches that translate strategy into construction structure without drowning in detail have been conceived as separate models in strategy research. They make use of coarse grained building blocks for modelling impact of strategy, such as business components in business strategy methods (Flaxer et al. 2005) or capabilities in strategy research (Sandkuhl and Stirna 2018), but also these approaches identify the set that is required in full, and are method focused, with a focus on contents that is limited to industry specific reference models of business components.
- Coarse grained artifacts that can act as carriers of alignment knowledge in specific domains have originated in the last decade spot wise, yet not integrated into an overall theoretical approach (see Appendix C). We have used them as inspiration to identify alignment artifacts in domains in Sect. 4.

## B Full demonstration in a case

This appendix instantiates the full set of artifacts and alignment attributes for a "real-life" case from the practice of the authors. It has been developed by one of the authors, who was engaged in an interim role as enterprise architect at a global construction and engineering company that was aspiring a digital transformation. In that role he was responsible for the overall architecture required for this transformation. The results of a two-step evaluation process with the key stakeholder, the Chief Digital Officer are included.

The example demonstrates that practitioners will be able to effectively base their alignment practices on the conceptualization we propose using artifact-based alignment chains across domains (1st objective in Sect. 1). The number of attributes that are used for matching is between 2 and 3 for every alignment relationship in each domain. This supports our premise that a limited number of attributes is sufficient to express the essentials of the alignment.

### B.1 Case Description

A global construction and engineering company that supports a broad portfolio of both built and natural assets in infrastructure, water, buildings and environment, is going through a transformation in which the ambition is to become a *digital frontrunner* in terms of digital contents delivered. Today this organization uses digital applications as supporting tools in their business, not as end-product. For example, engineers creating the design of a building using a 3D modelling package, or solution managers performing cost calculations of a high rise, using a bespoke developed estimating application. The strategic vision is to deliver digital contents as a part of the commercial portfolio. First as integrated service, for example a digital control cockpit with mobile apps for field level data collection that is used by both program manager and customer to oversee the construction projects, that becomes owned by the customer after delivery and that can be used during the contracted maintenance services as well. But eventually as primary deliverables, that use the company's data and knowledge codified into solutions as separate products. For example, a cost benchmark with historic data on projects that is marketed separately and allows customers to perform a self assessment. Or design automation solutions that can design for example rail infra based upon a limited set of inputs parameters and can be used by the customer staff directly. Or a sensor based monitoring solution that reports on the performance of an asset after construction, etc. The company has grown through acquisitions in the past 20 years to a global presence in more than 40 countries. With efforts underway to consolidate, a large part of the portfolio is still regional. It will take time to execute the enabling actions such as standardizing and centralizing data, automating business operations and building a digital platform with data and analytics capabilities, a customer experience layer, and an integration capability that can ingest sensor data and ecosystems related information. To quickly move into the position of a digital frontrunner, the board has decided to spin off a separate *start-up* company focused on the digital business. It is set up with two recent acquisitions that offer digital services for asset management and a development group split off from the *parent* company with a set of shared applications developed in the past to support multiple projects.

## B.2 Demonstration

Digital leadership has already been developing most of the artifacts required to populate the framework. What is still required as part of the case, is validate the alignment by documenting the artifact and their key characteristics and establishing the key matching attributes. Fig. 6 summarizes the results – the boxes in the domains contain a summary with key characteristics of the alignment artifacts, the bulleted lists on the connecting arrows contain the alignment rationale (see Fig. 3 for the explanation of the alignment model and its terminology).

### B.2.1 Production domain

*Production approach:* To start the digital transformation, a *dual-mode* strategy has been adopted. Both parent and start-up company can use their own production models, allowing each partner to develop from its own strength. The combination becomes a digital front-runner by creating an immediate presence in digital products from the start-up, with a large potential that may emerge from digitization of the current portfolio of the parent.

*Production model:* The parent company focuses on the first step of digitizing and automating current projects and maturing them into repeatable professional services that cover the full asset lifecycle with digital applications that are potential precursors to products. The start-up focuses immediately on a combination of professional services and packaged technology for selected product offerings. The combination delivers a broad portfolio of full asset lifecycle projects and services, as well as products.

*Business and IT Resources:* A new digital platform is planned across parent and start-up company for developing digital products. The platform is layered and includes standardized integration capabilities. The applications that it supports are based on a componentized plug-in architecture that allows them to be shipped with or without platform. This approach provides flexibility in deployment into different client set-up's with different mixes of platform layers and components included. It also allows packaging into larger business and technology suites that can differentiate with respect to other providers by combining highly specific industry contents with a generic digital foundation.

*Alignment and Matching attributes:* The dual-mode production model delivers a portfolio structure that has been designed to match the end state already from the first day, and supports the shift during the transformation across projects, services and products. This creates an approach that is

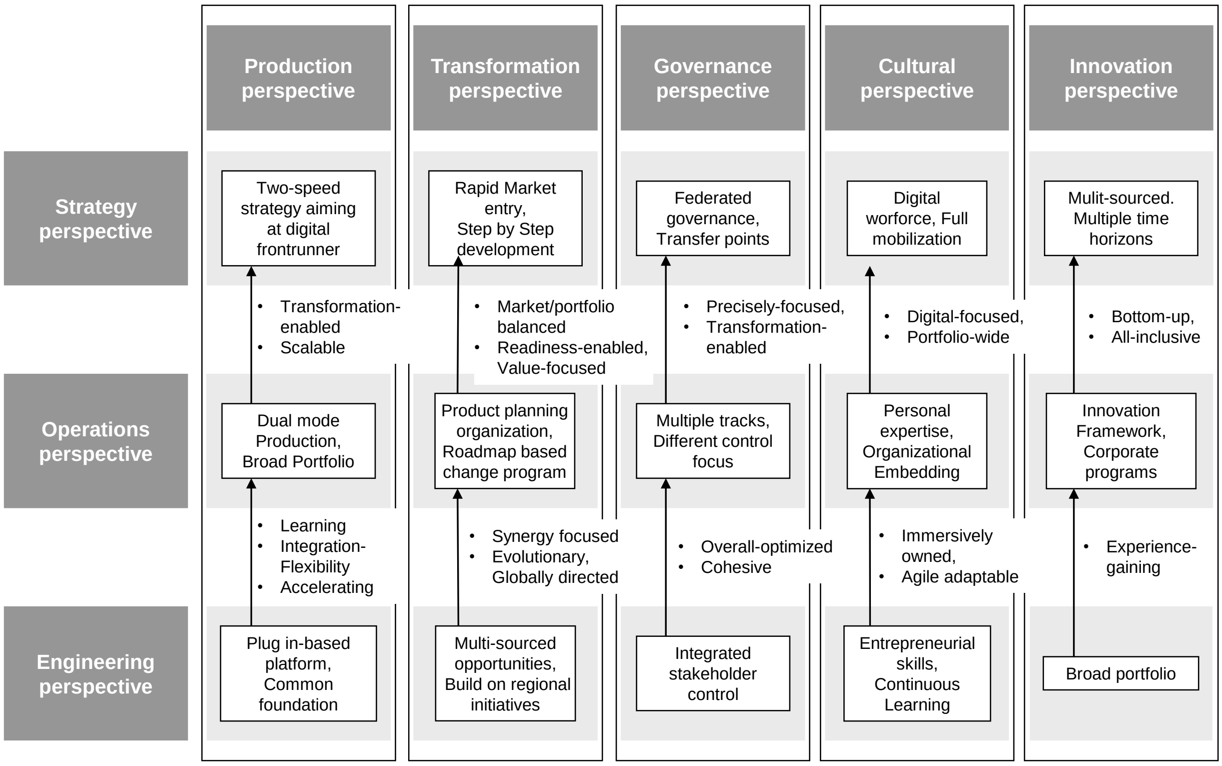


*Figure 6: Case instantiation*

*transformation-enabled* (combining start, intermediate and end state into one set-up). Where the *start-up* is a small venture, the *parent* company provides scale and market entry options. This creates an approach that is *scaleable* (allowing to start small and growing rapidly). The layered platform foundation and the componentized architecture deliver a product portfolio that can integrate into multiple types of client IT set-ups, and in this way creates *integration-flexibility*. The joint development of the platform across parent and start-up company allows learning across the full portfolio and allows accelerating by using the start-up company as test bed and the parent as reservoir with potential.

### B.2.2 Transformation domain

*Transition approach:* The transition approach combines speed with time to mature. Rapid market entry for the start-up is supported by the acquired portfolio with investments that leverage partnerships. The current business in the parent company is developed step by step to increase the level of standardization, digitization and automation.

*Business and IT change program:* The start-up company addresses the end state immediately by installment of a new product strategy and planning organization. This organization starts with the products from the acquisitions and further develops this portfolio. A roadmap-based change program is installed in the parent company that addresses the digitization of the current portfolio, controlled by newly appointed business area leaders.

*Business and IT work:* The product planning organization in the start-up company addresses market opportunities that stem from innovation ideas contributed from multiple sources including the parent organization. Planning in the parent company integrates regional planning into a single roadmap. This implies seeding, fostering and embracing regional initiatives that contribute to a global digital platform and that develop applications in line with strategic projections for the various business areas.

*Alignment and Matching attributes:* The product planning organization in the start-up company selects new product initiatives for development based upon market potential, and foundational synergies in the overall portfolio. It creates an approach that is *market/portfolio balanced*. The product development also leverages the large reservoir of developments in the parent company. This creates an approach that is *synergy focused*. The roadmap-based change program in the parent company that lifts the current business step by step prioritizes investments in those areas that are identified as strategic directions. A crucial criterion here is that steps are only taken if the internal organization is ready and there is a clear client value. This creates an approach that is *readiness-enabled* and *value-focused*. The roadmap-based change program aligns the current regional planning and funding into a joint strategic planning model. This creates an approach that is *evolutionary*, and *globally directed*.

### B.2.3 Governance domain

*Business and IT Control approach:* The control approach is a federated approach across parent and start-up company, with transfer points on which projects, services and products are handed over.

*Business and IT Governance model:* The governance model consists of multiple separate governance tracks with different control focus. Projects are controlled regionally in the parent company, services globally in the parent company, and products globally in the start-up company.

*Business and IT Stakeholders:* Stakeholder control is overall integrated through various control bodies that are spread out across. The parent company includes integrated portfolio management across regions and global, an enterprise architecture organization that guides and controls, and specific regional boards that filter initiatives with global potential. A central product board is installed in the start-up company that governs initiatives put forward as products.

*Alignment and Matching attributes:* The governance model with multiple control scopes and transition points has been designed to balance the focus across the central versus regional perspective, the platform versus application perspective, and projects/services versus product perspective. It supports the different stages in the transformation already from day one, gives clear visibility and equal rights to each, and bridges across them. This creates an approach that is *precisely focused*, *transformation enabled*. The integrated control through stakeholders at various decision points with local versus overall responsibilities creates an *overall-optimized* and *cohesive model*.

### B.2.4 Innovation domain

*Business and IT differentiation approach:* The innovation approach adopted is a multi-sourced approach with innovations originating from across the full labor force, from organizational units, and from corporate initiatives — across multiple time horizons (short, near and longer term).

*Business and IT Innovation program:* An innovation framework has been developed that assesses innovations that are proposed from different sources through an integrated decision process, with separate bodies that judge project, service and product innovations. Several additional corporate programs have been set up to explore other possible innovation options

*Business and IT Options:* Innovation options constitute a broad portfolio that covers internal proposals, strategic partnerships with large vendors, co creation with start-ups, hackathons, innovation labs, joint ventures and take overs.

*Alignment and Matching attributes:* The innovation model that has been designed to gather innovation ideas across the full labor force, emphasizes the envisioned role of the individual employee. It results in a *bottom-up*, *all-inclusive focus*. The additional mix of corporate programs has been designed to experiment with different formats, across the different horizons. It results in *experience-gaining* approach that creates *empowered forward thinking* at corporate levels.

### B.2.5 Culture domain

*Business and IT Value approach:* The cultural approach adopted is to embrace digital experiences as a core value. The target is to mobilize the full labor force around the digital journey and develop in this way the new digital workforce of the future bottom up.

*Business and IT Behavior model:* The required digital expertise for the intended behavior is enabled through person focused online education, and ongoing leadership communication. Organizational embodiment is achieved by embedding digital leadership in the various business areas and installing technical competence networks around clusters of technology.

*Business and IT Attitudes* Core attributes that are required emphasize entrepreneurial skills, and a culture of continuous learning.

*Alignment and Matching attributes:* The mobilization of the full workforce around the digital leverages the strong technical base of the engineering profession and infuses the full portfolio of projects with digital ambitions. It results in a *digital-focused*, *portfolio-wide culture*. The development of personal attitudes that emphasize entrepreneurship and the culture of continuous learning create *immersive ownership* and *agile adaptivity*.

### B.2.6 Horizontal alignment

Examples from horizontal domain alignments (not shown in Fig. 4) include:

- *Aligning production model and governance model:* both models use projects, services and products as the overall portfolio to be managed across parent and start-up companies, with transfer points in the governance model used for alignment on the boundaries.
- *Aligning production model and transformation model:* product planning and roadmap-based transition planning are disjunct transformation models that have been selected to match the immediate installment of a product planning organization in the start-up company, and the steps by step maturing of the project/service production in the parent company.

## B.3 Evaluation

After documenting the case instantiation, a two-step evaluation process with the Chief Digital Officer was performed. As a first step this Appendix B of the paper was presented for reading by the CDO to get initial feedback. This resulted in an initial set of comments that addressed completeness, the extent to which the description was self explanatory, and when to use the approach. Missing elements included the impact on the workforce (extensions with digital skills for engineers and an increased emphasis on software development), and the deep expected impact on the financial model (from hourly rate billing to license revenue). From the feedback it was clear that a more extensive interaction was required to convey the alignment reasoning. As a second step therefore a workshop was arranged to jointly discuss and agree the key alignment dependencies. This resulted in a shared and agreed understanding. It was noted that the objective of the paper was not to present a method to apply the approach. This observation has been included in the Discussion section of the paper.

Workforce and financial model have been identified as potential areas for extension — that will have to be included in a future second iteration of the design of the artifacts with the following options:

- Workforce could be integrated into the Cultural domain that includes the behavioral model, with personal values as construction elements. This would require addition of skills and competence areas. Alternatively, it could be integrated into the production domain, considering employees as human resources.
- Financial model could be integrated into the production domain, considering the shift from hourly rates-based revenue to license revenue as a strategic objective. See also the Discussion section for a potential cross sectional extension using views to bundle similar aspects across domains.

# C Examples of current artifact related research

This appendix illustrates how representative examples of current research selected by each author in their area of expertise to demonstrate coverage, can be classified according to the knowledge model: basic insights into the existence of artifact classes and relationships (Level 1), identifying contextual patterns (Level 2), and understanding foundational forces (Level 3). What the overview demonstrates is that artifact related research is being conducted at all levels of the knowledge model, and that researchers will be able to provide actionable knowledge to practitioners (2nd objective from Sect. 1), by organizing results of alignment research into the proposed knowledge model. However, what also surfaces is the lack of *epistemological grounding* — the research design is not *wired* into the knowledge need of practitioners. Research results are isolated and do not contribute to a systematic building of a body of knowledge. The artifact focus is intuitive and not explicit.

## C.1 Selected examples for Production domain

- *Engineering perspective:* research on the *economic* trade-off between an artifact's scope and increased complexity (Winter 2011) provides insights into explaining the bandwidth that a production model's resources will support versus their construction cost (Level 2 knowledge).
- *Operations perspective:* research on production models (Ross et al. 2011) and business models (Osterwalder and Pigneur 2010) provides insights into existence and categorization of different types of production models and essential constituents of a business model (Level 1 knowledge) and on how specific business model types match specific contexts (Level 2 knowledge). Henfridsson and Bygstad (2013) identify generative mechanisms that drive the development of digital infrastructure (Level 2 knowledge). Gregor (2009) identifies the theory of interpersonal trust from the social sciences to explain how trust is engendered in online communications (Level 2 knowledge). .
- *Strategic perspective:* research on the resource-based view of the firm (Bharadwaj 2000; Wernerfelt 1984) provides insight into the foundation that unique combinations of resources create for competitive advantage (Level 3 knowledge).

## C.2 Selected examples for Transformation domain

- *Engineering perspective:* practitioner methods (MSP 2023) backed up by research (Uhl and Gollenia 2016) provide prescriptive insight in how to engineer transformation programs (Level 1 knowledge) in specific contexts (Level 2 knowledge).
- *Operations perspective:* research on types of change landscapes such as simple, rugged or dancing rugged (Tanriverdi et al. 2010), type of change scopes such as routine, transitional and foundational (Bruls et al. 2021) and types of change frequency such as punctuated equilibrium (Sabherwal et al. 2001) provides insights into existence and categorization of change situations (Level 1 knowledge) and their contextual application (Level 2 knowledge).
- *Strategic perspective:* research on options and value-based approaches to project portfolio management (Jeffery and Leliveld 2004) provides insights into explaining the relationship between the operational management of a transformation and strategic outcomes (Level 1 knowledge).

## C.3 Selected examples for Governance domain

- *Engineering perspective:* research on defining organizational roles and stakeholder involvement (Brown 1999; Rossouw and Van Vuuren 2003) provides insights into existence and categorization of stakeholder perspectives useful for engineering governance models (Level 1 knowledge).

- *Operations perspective:* research on assessing, stimulating and monitoring compliance (COBIT 2013; Foorthuis and Bos 2011; Weaver et al. 1999) provides insight into existence and categorization of compliance models used in operational governance models (Level 1 knowledge) and their match to specific contexts (Level 2 knowledge).
- *Strategic perspective:* research on alignment modes and cultures (DiMaggio and Powell 1983; Meyer and Rowan 1977; Rossouw and Van Vuuren 2003) provides insights into existence and categorization of governance approaches (Level 1 knowledge). Research on IT Governance Mechanisms and Strategic Alignment (Wu et al. 2015) provides insights into explaining how governance approaches affect organizational performance (Level 2 knowledge). Research on stakeholder perspectives (Freeman 2010) provides insight into the foundational drivers of governance approaches (Level 3 knowledge).

### C.4 Selected examples for Innovation domain

- *Engineering perspective:* research on innovation typology and terminology (Garcia and Calantone 2002; Rowley et al. 2011) provides insights into existence and categorization of innovation building blocks (Level 1 knowledge).
- *Operations perspective:* research on technology adoption (F. D. Davis 1989; Nill and Kemp 2009; Venkatesh and Davis 2000; Venkatesh et al. 2003) provides insight into explaining how new technologies are integrated into an enterprise portfolio (Level 2 knowledge)
- *Operations/Strategic perspective:* research on ways to manage innovations as a portfolio of options (Kogut and Kulatilaka 2001; Mathews 2010) provides insight into how a strategy should be created for controlling the adoption of innovation (Level 2 knowledge).
- *Strategic perspective:* research on business model innovation approaches (Giesen et al. 2007) provides insights into existence and categorization of adaptation scopes and innovation strategies (Level 1 knowledge) and how these match (Level 2 knowledge). Research on the Knowledge based view of the firm (Grant 1996)provides insights into the foundational forces (Level 3 knowledge).

### C.5 Selected examples for Culture domain

- *Engineering perspective:* research on cultural dimensions/values (Detert et al. 2000; Leidner and Kayworth 2006; Quinn and Rohrbaugh 1983) provides insights into existence and categorization of the elements that cultural models are constructed from (Level 1 knowledge).
- *Operations perspective:* research on cultural types and differentiations (Kappos and Rivard 2008; Sackmann 1992) provides insight on existence and categorization of different types of cultural models (Level 1 knowledge) and their contextual application (Level 2 knowledge)
- *Strategic perspective:* research on cultural change, action and sense making techniques (Leidner and Kayworth 2006; Perlow and Weeks 2002; Swidler 1986) provide insights into existence and categorizations of cultural models as part of strategy (Level 1 knowledge). Research on Norm and Attitude based theories rooted in the Social sciences (Leidner and Kayworth 2006) provide insight into the foundational forces (Level 3 knowledge).

### C.6 Horizontal Linkages

Examples of research that links domain perspectives include (Steenbergen 2011) that considers the influence of culture on enterprise architecture (relevant for the production domain), Quartel et al. (2012) that link the architecture that shapes the production systems and the portfolio of transformation projects, and Tiwana and Konsynski (2010) that consider the relationship between governance and organizational architecture (covered in the operating perspective in our categorization).

## D Expert Validation

To further validate our approach, we conducted interviews with six experts. The approach was presented in video calls using a 10 slide summary presentation, explaining the shortcomings of existing research, the proposed shift in approach, an explanation of each artifact, and a summary of the main characteristics differentiating these from those of the SAM-based and EA-based approach. Three evaluation questions were included. The first requested experts to identify both positive and negative aspects of artifacts on the two key utility criteria (Prat et al. 2015) *usefulness* and *ease of use* (see Sect. 2). Although we did not explicitly request feedback on the artifact structure (*simplicity*, *completeness*, and *consistency*), many interviewees commented on these as well. The second question presented interviewees with the two core objectives of the paper included in Sect. 1 and requested them to quantify the extent to which we achieved these on a scale of 1 to 5. The third question requested interviewees to reflect on gaps and recommendations for next design iterations.

Interviewees were hand-picked by authors ensuring no conflicts of interest. This resulted in two academic researchers (with interests in enterprise architecture and its practical application, and information systems evolution) and four practitioners (with roles ranging from strategy consulting through enterprise architecture to enterprise engineering — in house, as a consultant, or an independent owner). Researchers had affinity with practice, and vice versa. Two of the practitioners were published academic authors as well. In addition to their own introduction in the interview, Linkedin profiles were used to determine the interviewees role/function, industry, years in IT, and BITA related expertise (see Tab. 7). Interviews were recorded, with two authors present (with the lead author present in each interview), and minutes drawn from these shared with all authors. Highlights included in the paper were extracted by the lead author and validated for their significance by the second interviewer.

Most interviewees (1- 4, 6) were able to quickly relate to the approach and artifacts proposed, with an incidental misinterpretation that could be corrected easily (for example interpreting the knowledge model as a maturity model). Three interviewees (1, 2, 6) had positive outlooks on all aspects being questioned — with minor caveats — resulting in above average scores. Two interviewees (3, 4) emphasized that although the research view was useful, the translation into a practical approach suitable for practitioners was insufficient. This resulted in above average scores on the researcher perspective and (below) average scores on the practitioner perspective. In case of one interviewee (5), a practitioner with expertise in enterprise engineering and research interest in complex adaptive systems and anti-fragile systems, there was a deep disconnect on all three artifacts that could not be remedied in the interview. Models were questioned at length on their structure and compared to other known models on structure and appearance, examples of how they should be applied did not resonate. This resulted in below average scores on question 2.

### D.1 Interview summary

Tab. 7 summarizes interviewee profiles, scores on Question 2, and some typical comments during the interview. Responses to Question 3 identified the following areas for improvement (between parentheses the number interviewees that identified it). The complexity of the approach (5) was deemed necessary, but caveats were raised to balance the detail with the required oversight, and position it with the right user population that could interpret the results without blindly following it. Guidance to practitioners (3) and presentation techniques were judged as insufficient, and development of a clear methodology with a process of steps and instructions considered mandatory. Some form of quantification (3) was deemed necessary. This could either take the form of an assessment of the value realized by the strategy to compare it with other routes, or — more difficult — as the differential contributions that alignment efforts can make for a certain strategy. A clear specification

| No | Profile | Score (practice) | Score (research) | Typical Comments |
|---|---|---|---|---|
| 1 | Strategy consultant 25+ years of experience at global service provider. Published academic author on business model innovation and actionable architecture. | 4 | 4 | "actionability drives translating strategy into operations", "domains are manageable chunks that contain the right contents", "balance oversight with complexity", "users will need training". |
| 2 | Enterprise architect 10+years of EA experience in house in local, regional and global companies (healthcare, insurance, food and beverage). With considerable knowledge of academic research. | 4 | –[1] | "domain model would really help to structure the analysis through better mapping and segmentation", "alignment chains allow to zoom in", "current research is not in useful format; the knowledge model would fix that", "would use it as a tool not as a communication vehicle" |
| 3 | Enterprise architect consultant 20+ years of EA experience in public and finance. Published academic book author, managing director of small regional architecture company. | 1–2 | 4–5 | "contains a lot of potential value", "foundations are probably solid", "culture is an aspect, yes, but does it warrant a domain?", "a metamodel, very abstract", "difficult to apply", "translation into practice needs work" |
| 4 | Professor at university, 30+ years of experience in academical research, with side steps in joint industry research. Focus on enterprise architecture and its applications in practice | 3 | 5 | "clear theoretical foundation", "framework is very correct", "clear intent of reuse", "enhances communication", "practitioners need very concrete guidelines", "otherwise wouldn't know where to start" |
| 5 | Enterprise engineer, 5+ years of experience in analysis, 5+ in solution architecture, and 2 + in enterprise architecture. Broad interest in models, and expertise in complex adaptive systems and antifragile systems | 2 | 2 | "advantage of SAM is that everybody knows it", "not in love with the BITA approach", "models raise red flags, difficult to say why", "matrix approach is really limited for something as complex as this", "why add engineering layer, and not tactical", "why not use other models, e. g. Complex Adaptive Systems model", "no expert in knowledge based work, cannot comment on knowledge model" |
| 6 | Professor at university — 30+ years of experience in academical research with side steps in industry consulting. Focus on models, architecture description, and evolving information systems | 4 – 5[2] | 3 | "will improve alignment efficiency and effectiveness", "actionable findings should not be blindly followed", "focus on causality and coarse grained view is preferred to detailed prescriptive guidance in architecture methods", "add heuristics as useful knowledge", "not only analytical but also social stakeholder aspects", "this was what EA was meant to achieve", "framework itself should be subject to further research (e. g. completeness of horizontal axis, and knowledge formats)", "do we need a meta view that splits into alignment based on causal insights, and prescriptive architecture", "actionable findings for practitioners is a broader design science topic — really interesting" |

[1] being a practitioner, the subject did not want to claim authority on this
[2] Score was described as 'positive', but the scale too detailed to decide for 4 or 5, given the evaluation time available

*Table 7: Expert interviews: interviewee profiles, scores and typical comments*

was deemed necessary with follow-on work on the framework itself (3). This included: integration with EA, completeness of the domain model, forms in which the logic in the knowledge model becomes available (causal, heuristics, prescriptive). Finance was identified as a potential new domain (2) because of the considerable impact of changes (for example the shift of Profit and Loss responsibility from a central to a regional unit).

### D.2 Assessment of comments and recommendations

The overall complexity of the approach for particularly practitioners requires attention. This implies that part of the follow-on research will need to differentiate between the form in which research considers the alignment space, and how results are to be incorporated into the methods and competencies of practitioners. As an example, consider the notation style used in Appendix B. Where this produces a distinct and condensed summary, evaluation with the CDO required much more elaborate explanations in a workshop setting. And the examples include in Tab. 5 and Tab. 6 illustrate the typical textual argumentative style that enterprise decision makers are used to, rather than the visualizations in models used in Appendix B.

The recommendation to consider approaches to quantification and the observation that EA has an alignment purpose, emphasize the required positioning of the new conceptualization between both the SAM-based and the EA-based approach. Finance as a separate domain also had been raised by the CDO when reviewing the case of Appendix B. It plays a substantial role in for examples business models as well (Osterwalder and Pigneur 2010). Other suggestions for extensions such as adding a social and institutional perspective versus the current analytical focus, and different representations and sources of knowledge (causal, heuristics, procedural), emphasize the follow on work that is needed on the framework itself.

Finally it was clear that the full specification of the models needed further work. Certainly for expert 5 they were not obvious, but also other interviewees and anonymous reviewers emphasized the required careful detailing.

### D.3 Follow up

Results of the expert interviews have been used as follows. In a separate design iteration, the specification has been further detailed to the version that is now in the paper. Domain definitions and their intended usage have been refined, and the alignment artifact specification detailed. Options for integration with SAM-based and EA-based approaches had already been developed but were not presented in the interview; they have been further strengthened in the same design iteration to the version that is now included in the Discussion. Other observations have been integrated into the discussion of weaknesses and as items for follow on design work. They are included and cross-referenced in the relevant subsections of the Discussion section. Scores on question 2 are used as evidence corroborating the two propositions on the approach. This is described in the Research method section, and discussed in the Evaluation section.

## References

Agarwal R., Lucas Jr H. C. (2005) The Information Systems Identity Crisis: Focusing on High-visibility and High-impact Research. In: MIS quarterly 29(3), pp. 381–398

Aier S., Winter R. (2009) Virtual Decoupling for IT/business Alignment–Conceptual Foundations, Architecture Design and Implementation Example. In: Business & Information Systems Engineering 1, pp. 150–163

van Aken J. E. (2004) Management Research based on the Paradigm of the Design Sciences: the Quest for Field-tested and Grounded Technological Rules. In: Journal of management studies 41(2), pp. 219–246

Albani A., Raber D., Winter R. (2016) A Conceptual Framework for Analysing Enterprise Engineering Methodologies. In: Enterprise Modelling and Information Systems Architectures (EMISAJ) 11, pp. 1–1

Amyot D., Akhigbe O., Baslyman M., Ghanavati S., Ghasemi M., Hassine J., Lessard L., Mussbacher G., Shen K., Yu E. (2022) Combining Goal Modelling with Business Process Modelling: Two Decades of Experience with the User Requirements Notation Standard. In: Enterprise Modelling and Information Systems Architectures (EMISAJ) 17, pp. 2–1

Andersen T. J., Nielsen B. B. (2009) Adaptive Strategy Making: the Effects of Emergent and Intended Strategy Modes. In: European Management Review 6(2), pp. 94–106

Arsanjani A., Ghosh S., Allam A., Abdollah T., Ganapathy S., Holley K. (2008) SOMA: a Method for Developing Service-oriented Solutions. In: IBM Systems Journal 47(3), pp. 377–396

Bagozzi R. P. (2011) Measurement and Meaning in Information Systems and Organizational Research: Methodological and Philosophical Foundations. In: MIS quarterly 35(2), pp. 261–292

Baskerville R., Pries-Heje J. (2010) Explanatory Design Theory. In: Business & Information Systems Engineering 2, pp. 271–282

Baskerville R., Pries-Heje J., Venable J. (2009) Soft Design Science Methodology. In: Proceedings of the 4th international conference on design science research in information systems and technology, DESRIST 2009, pp. 1–11

Baumöl U. (2005) Strategic Agility through Situational Method Construction. In: Proceedings of the Academy of Management Annual Conference Vol. 2005. Munich

Benbasat I., Zmud R. W. (2003) The Identity Crisis within the IS Discipline: Defining and Communicating the Discipline's Core Properties. In: MIS quarterly 27(2), pp. 183–194

Bergeron F., Raymond L., Rivard S. (2004) Ideal Patterns of Strategic Alignment and Business Performance. In: Information & management 41(8), pp. 1003–1020

Besson P., Rowe F. (2012) Strategizing Information Systems-enabled Organizational Transformation: a Transdisciplinary Review and New Directions. In: The journal of strategic information systems 21(2), pp. 103–124

Bharadwaj A. S. (2000) A Resource-based Perspective on Information Technology Capability and Firm Performance: an Empirical Investigation. In: MIS quarterly 24(1), pp. 169–196

Bhattacharya P. (2017) Modelling Strategic Alignment of Business and IT through Enterprise Architecture: Augmenting Archimate with BMM. In: Procedia computer science 121, pp. 80–88

Bleistein S. J., Cox K.and Verner J. (2006) Validating Strategic Alignment of Organizational IT Requirements using Goal Modeling and Problem Diagrams. In: Journal of Systems and Software 79(3), pp. 362–378

Brinkkemper S., Saeki M., Harmsen A. (1999) Meta-Modelling based Assembly Techniques for Situational (Method) Engineering. In: Information Systems 24(3), pp. 209–228

Brown C. V. (1999) Horizontal Mechanisms under Differing IS Organization Contexts. In: MIS quarterly 23(3), pp. 421–454

Bruls W., Giesen E., Lankhorst M., Winter R., Slaets H. (2021) Industry Solution Adaptability: An Integrated Solution Model and an Integrated Analysis and Engineering Method for Addressing Change in Large and Complex Enterprises. In: Enterprise Modelling and Information Systems Architectures (EMISAJ) 16(5), pp. 1–41

Bruls W., van Steenbergen M., Foorthuis R., Bos R., Brinkkemper S. (2010) Domain Architectures as an Instrument to Refine Enterprise Architecture. In: Communications of the Association for Information Systems 27(1), p. 27

Bucher T., Winter R. (2008) Dissemination and Importance of the "Method" Artifact in the Context of Design Research for Information Systems. In: Proceedings of the 3th international conference on design science research in information systems and technology, DESRIST 2008

Buhl H. U., Fridgen G., König W., Röglinger M., Wagner C. (2012) Where's the Competitive Advantage in Strategic Information Systems Research? Making the Case for Boundary-spanning Research based on the German Business and Information Systems Engineering Tradition. In: The Journal of Strategic Information Systems 21(2), pp. 172–178

Burton-Jones A., Lee A. S. (2017) Thinking about Measures and Measurement in Positivist Research: a Proposal for Refocusing on Fundamentals. In: Information systems research 28(3), pp. 451–467

CaaS (2023) Capability as a Service for Digital Enterprises, FP 7 ICT Programme Collaborative Project no: 611351

Campbell B., Kay R., Avison D. (2005) Strategic Alignment: a Practitioner's Perspective. In: Journal of Strategic Information Systems 18(6), pp. 653–664

Chan Y., Reich B. (2007) IT Alignment: what have we Learnt? In: Journal of Information Technology 22(4), pp. 297–315

COBIT (2013) COBIT, Control Objectives Vol. 3rd Edition. IT Governance Institute, Rolling Meadows, IL, ISACF

Coltman T., Tallon P., Rajeev Sharma R., Queiroz M. (2015) Strategic Alignment Twenty-five Years on. In: Journal of Information Technology 30(4), pp. 91–100

Cragg P., King M., Hussin H. (2002) IT Alignment and Firm Performance in small Manufacturing Firms. In: The journal of strategic information systems 11(2), pp. 109–132

Davis F. D. (1989) Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. In: MIS quarterly 13(3), pp. 319–340

Davis G. B. (2005) Advising and Supervising. In: Research in Information Systems: a Handbook for Research Supervisors and their Students. Amsterdam: Elsevier Butterworth Heinemann, pp. 3–34

De Haes S., Van Grembergen W. (2009) Enterprise Governance of Information Technology: Achieving Strategic Alignment and Value. Springer

Detert J. R., Schroeder R. G., Mauriel J. J. (2000) A Framework for Linking Culture and Improvement Initiatives in Organizations. In: Academy of management Review 25(4), pp. 850–863

DID (2023) The Future of Business Information Management Best Practice

Dietz J. L., Hoogervorst J. A., Albani A., Aveiro D., Babkin E., Barjis J., Caetano A., Huysmans P., Iijima J., van Kervel S., et al. (2013) The Discipline of Enterprise Engineering. In: International Journal of Organisational Design and Engineering 3(1), pp. 86–114

DiMaggio P. J., Powell W. W. (1983) The Iron Cage Revisited: Institutional Isomorphism and Collective Rationality in Organizational Fields. In: American sociological review, pp. 147–160

Fiske S. T., Taylor S. E. (1991) Social cognition. Mcgraw-Hill Book Company

Flaxer D., Nigam A., Vergo J. (2005) Using Component Business Modeling to Facilitate Business Enterprise Architecture and Business Services at the US Department of Defense. In: Proceedings of the 2005 IEEE International Conference on e-Business Engineering, pp. 755–760

Foorthuis R., Bos R. (2011) A Framework for Organizational Compliance Management Tactics. In: Advanced Information Systems Engineering Workshops: CAiSE 2011 International Workshops, London, UK, June 20-24, 2011. Proceedings 23. Springer, pp. 259–268

Foorthuis R., Brinkkemper S. (2008) Best Practices for Business and Systems Analysis in Projects Conforming to Enterprise Architecture. In: Enterprise Modelling and Information Systems Architectures (EMISAJ) 3(1), pp. 36–47

Forrester (2023) Business Alignment

Freeman R. E. (2010) Strategic Management: a Stakeholder Approach. Cambridge university press

Furrer O., Thomas H., Goussevskaia A. (2008) The Structure and Evolution of the Strategic Management Field: A Content Analysis of 26 Years of sStrategic Management Research. In: International journal of management reviews 10(1), pp. 1–23

Gajardo P. A., La Paz A. I. (2021) Measuring Business-IT Alignment in a Digitally Revolutionized Economy. In: Research Anthology on Digital Transformation, Organizational Change, and the Impact of Remote Work. IGI Global, pp. 886–907

Garcia R., Calantone R. (2002) A Critical Look at Technological Innovation Typology and Innovativeness Terminology: a Literature Review. In: Journal of Product Innovation Management: An international publication of the product development & management association 19(2), pp. 110–132

Gartner (2019) Business Alignment Survey

Gerow J. E., Grover V., Thatcher J., Roth P. L. (2014) Looking toward the Future of IT–business Strategic Alignment through the Past. In: MIS quarterly 38(4), pp. 1159–1186

Giesen E., Berman S., Bell R., Blitz A. (2007) Three Ways to Successfully Innovate your Business Model. In: Strategy Leadership 35(6), pp. 27–33

Gill G., Bhattacherjee A. (2009) Whom are we Informing? Issues and Recommendations for MIS Research from an Informing Sciences Perspective. In: MIS quarterly 33(2), pp. 217–235

Goldkuhl G. (2004) Design Theories in Information Systems – a Need for Multi-Grounding. In: Journal of Information Technology Theory and Application (JITTA) 6(2), pp. 59–72

Grant R. M. (1996) Toward a Knowledge-based Theory of the Firm. In: Strategic management journal 17(S2), pp. 109–122

Gregor S., Martin N. (2007) Enterprise Architecture: Enablers of Business Strategy and IS/IT Alignment in Government. In: Information Technology & People 20(2), pp. 96–120

Gregor S. (2006) The Nature of Theory in Information Systems. In: MIS quarterly 30(3), pp. 611–642

Gregor S. (2009) Building Theory in the Sciences of the Artificial. In: Proceedings of the 4th international conference on design science research in information systems and technology, DESRIST 2009, pp. 1–10

Gregor S., Chandra Kruse L., Seidel S., et al. (2020) Research Perspectives: the Anatomy of a Design Principle. In: Journal of the Association for Information Systems 21(6), pp. 1622–1652

Gregor S., Hevner A. (2013) Positioning and Presenting Design Science Research for Maximum Impact. In: MIS quarterly 37(2), pp. 337–356

Gregory R., Muntermann J. (2013) Research note – Heuristic Theorizing: Proactively Generating Design Theories. In: Information Systems Research 25(3), pp. 639–653

Grover V., Lyytinen K., Srinivasan A., Tan B. C. (2008) Contributing to Rigorous and Forward Thinking Explanatory Theory. In: Journal of the Association for Information Systems 9(2), pp. 40–47

Habermas J. (1985) The Theory of Communicative Action: Volume 1: Reason and the Rationalization of Society. Beacon press

Hair J., Black W., Babin B., Anderson R. (2009) Multivariate Data Analysis 7th Edition. Pearson Prentice Hall

Harishankar R., Daley S. (2011) Actionable Business Architecture. In: Seventh IEEE International Conference on E-Commerce Technology (CEC'05). IEEE Computer Society, pp. 318–324

Henderson J., Venkatraman N. (1993) Strategic Alignment: Leveraging Information Technology for Transforming Orgnanisations. In: IBM Systems Journal 32(1), pp. 4–16

Henfridsson O., Bygstad B. (2013) The Generative Mechanisms of Digital Infrastructure Evolution. In: MIS quarterly 37(3), pp. 907–931

Hevner A. R., March S. T., Park J., Ram S. (2004) Design Science in Information Systems Research. In: MIS quarterly 28(1), pp. 75–105

Jeffery M., Leliveld I. (2004) Best Practices in IT Portfolio Management. In: MIT Sloan Management Review

Jonkers H., Lankhorst M. M., Ter Doest H. W., Arbab F., Bosma H., Wieringa R. J. (2006) Enterprise Architecture: Management Tool and Blueprint for the Organisation. In: Information systems frontiers 8(2), p. 63

Jonkers H., Proper E., Turner M. (2009) TOGAF™ and ArchiMate®: A future together. In: White Paper W 192

Kaidalova J., Seigerroth U., Persson A. (2017) Enterprise Modeling for Business and IT (Alignment) - a Framework and Recommendations. In: Complex Systems Informatics and Modeling Quarterly 12, pp. 66–85

Kappos A., Rivard S. (2008) A Three-perspective Model of Culture, Information Systems, and their Development and Use. In: MIS quarterly 32(3), pp. 601–634

Kearns G. S., Lederer A. L. (2000) The Effect of Strategic Alignment on the Use of IS-based Resources for Competitive Advantage. In: The Journal of Strategic Information Systems 9(4), pp. 265–293

Khademhosseinieh B., Seigerroth U. (2011) An Evaluation of Enterprise Modelling Methods in the Light of Business and IT Alignment. In: ICEIS - 13th International Conference on Enterprise Information Systems, pp. 479–484

Kogut B., Kulatilaka N. (2001) Capabilities as Real Options. In: Organization Science 12(6), pp. 744–758

Kuechler W., Vaishnavi V. (2008) The Emergence of Design Research in Information Systems in North America. In: Journal of Design Research 7(1), pp. 1–16

Kuechler W., Vaishnavi V. (2012) A Framework for Theory Development in Design Science Research: Multiple Perspectives. In: Journal of the Association for Information systems 13(6), pp. 395–423

Labusch N., Winter R. (2013) Towards a Conceptualization of Architectural Support for Enterprise Transformation. In: Proceedings of the 21st European Conference on Information Systems, ECIS 2013. Association for Information Systems

Lankhorst M. (2012) Agile Service Development – Combining Adaptive Methods and Flexible Solutions. Springer

Lankhorst M. (2017) Enterprise Architecture at Work. Springer

Lee A. S., Baskerville R. L. (2003) Generalizing Generalizability in Information Systems Research. In: Information systems research 14(3), pp. 221–243

Leidner D. E., Kayworth T. (2006) A Review of Culture in Information Systems Research: Toward a Theory of Information Technology Culture Conflict. In: MIS quarterly 30(2), pp. 357–399

Levi K., Arsanjani A. (2002) Mapping a Business Architecture to a Component–based Software Architecture. A Goal–driven Approach to Enterprise Component Identification and Specification. In: Communications of the ACM 45(10), pp. 45–52

Luftman J., Ben-Zvi T. (2010) Key Issues for IT Executives 2009: (Difficult) Economy's Impact on IT. In: MIS Quarterly Executive 9(1), pp. 49–59

Luftman J., Lyytinen K., Ben-Zvi T. (2015) Enhancing the Measurement of Information Technology (IT) Business Alignment and its Influence on Company Performance. In: Information Technology 23(3), pp. 1–21

Maes R. (1998) Short Outline of a Generic Framework for Information Management. In: Proceedings First European Conference on Accounting Information Systems

Maes R., Rijsenbrij D., Truijens O., Goedvolk H. (1999) A Generic Framework for Information Management. University of Amsterdam, Department of Accountancy and Information Management, Prima Vera Working Paper

March S., Smith G. (1995) Design and Natural Science Research on Information Technology. In: Decision Support Systems 15(4), pp. 251–266

Markus M. L., Saunders C. (2007) Editor's Comments: Looking for a few good Concepts... and Theories... for the Information Systems Field. In: MIS quarterly 31(1), pp. iii–vi

Mathews S. (2010) Innovation Portfolio Architecture. In: Research-Technology Management 53(6), pp. 30–40

McDavid D. W. (1999) A Standard for Business Architecture Description. In: IBM Systems Journal 38(1), pp. 12–31

McLaren T. S., Head M. M., Yuan Y., Chan Y. E. (2011) A Multilevel Model for Measuring Fit between a Firm's Competitive Strategies and Information Systems Capabilities. In: Journal of Strategic Information Systems 35(4), pp. 909–929

Meertens L. O., Iacob M.-E., Nieuwenhuis L. J., van Sinderen M. J., Jonkers H., Quartel D. (2012) Mapping the Business Model Canvas to ArchiMate. In: Proceedings of the 27th annual ACM symposium on applied computing, pp. 1694–1701

Menz M. (2012) Functional Top Management Team Members: a Review, Synthesis, and Research Agenda. In: Journal of Management 38(1), pp. 45–80

Merali Y., McKelvey B. (2006) Using Complexity Science to Effect a Paradigm Shift in Information Systems for the 21st Century. In: Journal of Information technology 21(4), pp. 211–215

Meyer J. W., Rowan B. (1977) Institutionalized Organizations: Formal Structure as Myth and Ceremony. In: American journal of sociology 83(2), pp. 340–363

MSP (2023) Managing Successful Programs

Nickerson R., Varshney U., Muntermann J. (2013) A Method for Taxonomy Development and its Application in Information Systems. In: Information Systems Research 22(3), pp. 336–359

Niehaves B., Ortbach K. (2016) The Inner and the Outer Model in Explanatory Design Theory: the Case of Designing Electronic Feedback Systems. In: European Journal of Information Systems 25, pp. 303–316

Nill J., Kemp R. (2009) Evolutionary Approaches for Sustainable Innovation Policies: from Niche to Paradigm? In: Research policy 38(4), pp. 668–680

Onik M. F. A., Fielt E., Gable G. (2017) Complex Adaptive Systems Theory in Information Systems Research: a Systematic Literature Review. In: Proceedings of the 21st Pacific Asia Conference on Information Systems (PACIS) 2017. Association for Information Systems (AIS), pp. 1–14

Orlikowski W., Iacono C. (2001) Desparately Seeking the 'IT' in IT Research - A Call to Action. In: Information Systems Research 12(2), pp. 121–134

Osterwalder A., Pigneur Y. (2010) Business Model Generation: a Handbook for Visionaries, Game Changers, and Challengers Vol. 1. John Wiley & Sons

Osterwalder A., Pigneur Y., Tucci C. (2005) Clarifying Business Models: Origins, Present, and Future of the Concept. In: Communications of the Association for Information Systems 16, pp. 1–25

Peffers K., Tuunanen T., Rothenberger M. A., Chatterjee S. (2007) A Design Science Research Methodology for Information Systems Research. In: Journal of management information systems 24(3), pp. 45–77

Peppard J., Ward J. (1999) 'Mind the Gap': Diagnosing the Relationship between the IT Organisation and the Rest of the Business. In: The Journal of Strategic Information Systems 8(1), pp. 29–60

Perlow L., Weeks J. (2002) Who's Helping Whom? Layers of Culture and Workplace Behavior. In: Journal of Organizational Behavior: The International Journal of Industrial, Occupational and Organizational Psychology and Behavior 23(4), pp. 345–361

Petter S., Straub D., Rai A. (2007) Specifying Formative Constructs in Information Systems Research. In: MIS quarterly 31(4), pp. 623–656

Piccoli G., Ives B. (2005) IT-dependent Strategic Initiatives and Sustained Competitive Advantage: a Review and Synthesis of the Literature. In: MIS quarterly 29(4), pp. 747–776

Pijpers V., De Leenheer P., Gordijn J., Akkermans H. (2012) Using Conceptual Models to Explore Business-ICT Alignment in Networked Value Constellations: Case Studies from the Dutch Aviation Industry, Spanish Electricity Industry and Dutch Telecom Industry. In: Requirements Engineering 17, pp. 203–226

Porter M. E. (1985) Competitive Advantage. New York: Free Press

Prat N., Comyn-Wattiau I., Akoka J. (2015) A Taxonomy of Evaluation Methods for Information Systems Artifacts. In: Journal of Management Information Systems 32(3), pp. 229–267

Proper E., Aveiro D., Gaaloul K. (2013) Advances in Enterprise Engineering VII. EEWC 2013. Lecture Notes in Business Information Processing Vol. 146. Springer

Proper E., Winter R., Aier S., De Kinderen S. (2017) Architectural Coordination of Enterprise Transformation. Springer

Quartel D., Steen M. W., Lankhorst M. M. (2012) Application and Project Portfolio Valuation using Enterprise Architecture and Business Requirements Modelling. In: Enterprise Information Systems 6(2), pp. 189–213

Queiroz M., Tallon P. P., Coltman T., Sharma R., Reynolds P. (2020) Aligning the IT Portfolio with Business Strategy: Evidence for Complementarity of Corporate and Business Unit Alignment. In: The Journal of Strategic Information Systems 29(3), pp. 1–15

Quinn R. E., Rohrbaugh J. (1983) A Spatial Model of Effectiveness Criteria: Towards a Competing Values Approach to Organizational Analysis. In: Management science 29(3), pp. 363–377

Ray G., Muhanna W. A., Barney J. B. (2005) Information Technology and the Performance of the Customer Service Process: a Resource-based Analysis. In: MIS quarterly 29(4), pp. 625–652

Ross J., Weill P., Robertson D. (2011) Enterprise Architecture as Strategy. In: Journal of Strategic Information Systems 35(4), pp. 909–929

Rossouw G. J., Van Vuuren L. J. (2003) Modes of Managing Morality: a Descriptive Model of Strategies for Managing Ethics. In: Journal of Business Ethics 46, pp. 389–402

Rouhani B. D., Mahrin M. N., Nikpay F., Ahmad R. B., Nikfard P. (2015) A Systematic Literature Review on Enterprise Architecture Implementation Methodologies. In: Information and Software Technology 62, pp. 1–20

Rowley J., Baregheh A., Sambrook S. (2011) Towards an Innovation-type Mapping Tool. In: Management Decision 49(1), pp. 73–86

Saat J., Winter R., Franke U., Lagerström R., Ekstedt M. (2011) Analysis of IT/Business Alignment Situations as a Precondition for the Design and Engineering of Situated IT/Business Alignment Solutions. In: 44th Hawaii International Conference on System Sciences. IEEE, pp. 1–9

Sabherwal R., Hirschheim R., Goles T. (2001) The Dynamics of Alignment: Insights from a Punctuated Equilibrium Model. In: Organization science 12(2), pp. 179–197

Sabherwal R., Jeyaraj A. (2015) Information Technology Impacts on Firm Performance. In: MIS quarterly 39(4), pp. 809–836

Sackmann S. A. (1992) Culture and Subcultures: an Analysis of Organizational Knowledge. In: Administrative science quarterly 37(1), pp. 140–161

Sandkuhl K., Stirna J. (2018) Capability Management in Digital Enterprises. Springer

Schlosser F., Wagner H., Coltman T. (2012) Rethinking the Dimensions of Business–IT Alignment. In: 45th Hawaii International Conference on System Sciences. IEEE, pp. 5503–5061

Schryen G. (2013) Revisiting IS Business Value Research: What we already Know, What we still Need to Know, and How we can get There. In: MIS Quarterly 22(2), pp. 139–169

Shah S. K., Corley K. G. (2006) Building Better Theory by Bridging the Quantitative–Qualitative Divide. In: Journal of management studies 43(8), pp. 1821–1835

Shapere D. (1977) Scientific Theories and Their Domains. In: The Structure of Scientific Theories, 2nd edition. Urbana, Chicago, London: University of Illinois press, pp. 518–565

Simon H. (1996) The Science of the Artificial. MIT Press, Cambridge

van Steenbergen M. (2011) Cultural Impact Model for Enterprise Architecture. In: Maturity and Effectiveness of Enterprise Architecture. PhD thesis, Utrecht University, pp. 157–193

van Steenbergen M., Brinkkemper S. (2010) Modeling the Contribution of Enterprise Architecture Practice to the Achievement of Business Goals. In: Proceedings of the 17th international conference on Information Systems Development (ISD 2008). Springer, pp. 609–618

Straub D. (2012) Editor's Comments: Does MIS Have Native Theories? In: MIS quarterly 36(2), pp. iii–xii

Strong D., Volkoff O. (2005) Understanding Organization–Enterprise System Fit: a Path to Theorizing the Information Technology Artefact. In: MIS Quarterly 34(4), pp. 731–775

The Structure of Scientific Theories, 2nd edition. Urbana, Chicago, London: University of Illinois press

SWEBOK (2023) Software Engineering Body of Knowledge

Swidler A. (1986) Culture in Action: Symbols and Strategies. In: American sociological review 51(2), pp. 273–286

Tanriverdi H., Rai A., Venkatraman N. (2010) Research Commentary – Reframing the Dominant Quest of Information Systems Strategy Research for Complex Adaptive Business Systems. In: Information Systems Research 21(4), pp. 822–834

Teece D. J., Pisano G., Shuen A. (1997) Dynamic Capabilities and Strategic Management. In: Strategic management journal 18(7), pp. 509–533

Thuan N. H., Drechsler A., Antunes P. (2019) Construction of Design Science Research Questions. In: Communications of the Association for Information Systems 44, pp. 332–363

Tiwana A., Konsynski B. (2010) Complementarities between Organizational IT Architecture and Governance Structure. In: Information Systems Research 21(2), pp. 288–304

TOGAF (2023) The Open Group Architecture Framework

Uhl A., Gollenia L. A. (2016) A Handbook of Business Transformation Management Methodology. Routledge

UML (2023) Unified Modeling Language

Urquhart C., Lehmann H., Myers M. D. (2010) Putting the 'Theory' back into Grounded Theory: Guidelines for Grounded Theory Studies in Information Systems. In: Information systems journal 20(4), pp. 357–381

Van de Ven A. H., Drazin R. (1985) The Concept of Fit in Contingency Theory. In: Research in Organizational Behavior Vol. 2. Greenwhich CT: JAI Press, pp. 333–365 de Vaujany F. X. (2008) Strategic Alignment: What else? A Practice based View of IS Value. In: International Conference on Enterprise Information Systems - ICEIS

Venable J., Pries-Heje J., Baskerville R. (2016) FEDS: a Framework for Evaluation in Design Science Research. In: European Journal of Information Systems 25(1), pp. 77–89

Venkatesh V., Brown S. A., Bala H. (2013) Bridging the Qualitative-quantitative Divide: Guidelines for Conducting Mixed Methods Research in Information Systems. In: MIS quarterly 37(1), pp. 21–54

Venkatesh V., Davis F. D. (2000) A Theoretical Extension of the Technology Acceptance Model: Four Longitudinal Field Studies. In: Management science 46(2), pp. 186–204

Venkatesh V., Morris M. G., Davis G. B., Davis F. D. (2003) User Acceptance of Information Technology: Toward a Unified View. In: MIS quarterly 27(3), pp. 425–478

Venkatraman N. (1989) The Concept of Fit in Strategy Research: Toward Verbal and Statistical Correspondence. In: Academy of Management Review 14(3), pp. 423–444

Walentowitz K. (2012) Aligning Multiple Definitions of Alignment–A Literature Review. In: 45th Hawaii International Conference on System Sciences. IEEE, pp. 4962–4971

Walraven P., van de Wetering R., Helms R. W., Versendaal J., Caniëls M. C. (2018) Co-evolutionary IS-alignment: a Complex Adaptive Systems Perspective. In: The 12th Mediterranean Conference on Information Systems, p. 27

Ward J. M. (2012) Information Systems Strategy: Quo Vadis? In: The Journal of Strategic Information Systems 21(2), pp. 165–171

Weaver G. R., Trevino L. K., Cochran P. L. (1999) Corporate Ethics Programs as Control Systems: Influences of Executive Commitment and Environmental Factors. In: Academy of Management journal 42(1), pp. 41–57

Weber R. (2021) Constructs and Indicators: an Ontological Analaysis. In: MIS Quarterly 45(4), pp. 1644–1678

Wernerfelt B. (1984) A Resource-based View of the Firm. In: Strategic management journal 5(2), pp. 171–180

Winter R. (2011) Problem Analysis for Situational Artefact Construction in Information Systems. In: Emerging themes in information systems and organization studies. Springer, pp. 97–113

Wu S. P.-J., Straub D. W., Liang T.-P. (2015) How Information Technology Governance Mechanisms and Strategic Alignment Influence Organizational Performance. In: MIS quarterly 39(2), pp. 497–518

Youngs R., Redmond-Pyle D., Spaas P., Kahan E. (1999) A Standard for Architecture Description. In: IBM Systems Journal 38(1), pp. 32–50

Zachariadis M., Scott S., Barrett M. (2013) Methodological implications of critical realism for mixed-methods research. In: MIS quarterly 37(3), pp. 855–879

Zahra S., George G. (2002) Absorptive Capacity: a Review, Reconceptualization, and Extension. In: Academy of Management Review 27(2), pp. 185–203