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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

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Abstract In this paper, we introduce e^3 *alignment* for inter-organizational business-ICT alignment. With the e^3 *alignment* framework, we create alignment between organizations operating in an agile networked value constellation—which is a set of organizations who jointly satisfy a customer need—by (1) focusing on the *interaction* between the organizations in the constellation, (2) considering interaction from *four* different perspectives, and (3) utilizing conceptual *modeling techniques* to analyze and create alignment within and between the perspectives. By creating inter-organizational business-ICT alignment between the actors in the constellation, e^3 *alignment* ultimately contributes to a sustainable and profitable constellation. To actually create alignment, e^3 *alignment* iteratively takes three specific steps: (1) identification of alignment issues, (2) solution design, and (3) impact analysis. We illustrate our approach with cases from the Dutch aviation industry, Spanish electricity industry, and Dutch telecom industry.

Keywords Business-ICT alignment · Networked value constellations · Exploration phase · e^3 *alignment*

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1 Introduction

That information systems interact with their environment is without a doubt, but requirements engineering tends to underestimate the *complexity* of the business context of information systems. Nowadays the business context is even more complex because companies increasingly participate in agile *networked value constellations*—sets of organizations which collaborate to jointly satisfy a complex customer need [8, 40]. For example, consider the start-up business Mobzilli (http://www.mobzilli.com). Mobzilli offers a mobile application that allows users to view advertisements of Merchants (e.g., shops, etc) in the vicinity of the user's current location. So a user can use the app to view advertisements of the stores of the shopping mall she/he is in. Before Mobzilli can design its information systems, it first has to choose and design a proper business context. For example, Mobzilli needs to figure out who their exact customer group is (e.g., what kind of mobile phones?) and with which partners they are going to collaborate (e.g., which technologies to use?). But the environment of Mobzilli is extremely agile. New mobile phones with new technologies emerge constantly and customers frequently switch mobile phones, causing technological obstacles. Dealing with this agile business environment is a real challenge for Mobzilli.

The interplay between the business context and the design of information systems is often referred to as *business-ICT alignment*. Organizations that have properly aligned their business with IT outperform those organizations that have not [7, 39].

Recently, Chan and Reich [7] published an article summarizing and analyzing over 150 articles concerned with aligning business and IT in organizations. Most of the work analyzed by Chan and Reich [7] just focuses on

business-ICT alignment within a *single* organization, while we argue that alignment issues exist between *multiple* organizations in networked value constellations also. For instance, Mobzilli not only has to be aligned with the organizations in their environment at a business level (e.g., each actor makes profits), but the various information systems supporting the constellation also have to be interoperable (e.g., exchangeable data formats).

Another challenge for business-ICT alignment research is the "process of alignment," which is concerned with how to *analyze* and *create* business-ICT alignment in a structured and repeatable manner [7, 39]. Part of the "process of alignment" is the *exploration* phase in which alignment issues are elicited and (alternative) solutions are considered on a high abstraction level. In requirements engineering, the exploration phase is often referred to as the *early phase of requirements engineering*. The early phase of requirements engineering takes place as the first activity in a requirements engineering cycle and is concerned with eliciting business requirements from the business context [49].

Therefore, we attempt in this paper to answer the following research question:

> How to analyze and create inter-organizational business-ICT alignment in the context of an agile networked value constellation?

In answering the question, we introduce e^3 *alignment*. With e^3 *alignment*, it is possible to explore a wide range of *inter-organizational business-ICT alignment* issues concerning the *interaction* between organizations—and their information systems—operating in networked value constellations. e^3 *alignment* analyzes interactions between organizations from *multiple perspectives* with the aid of *conceptual modeling techniques*. e^3 *alignment* utilizes lightweight, yet well-founded ontological modeling techniques to analyze and create business-ICT alignment. Utilizing modeling techniques enables us to create shared understanding among stakeholders [6], allows for traceability of changes over the perspectives [25], and closely resembles the way of working in information system design. In addition, to actually execute the process of alignment, we use the conceptual modeling techniques in three iterative steps: (1) identification of alignment issues, (2) design of alignment solution, and (3) alignment impact analysis.

With e^3 *alignment*, we focus on the *interaction* between organizations to create alignment, because we see interaction as one of the success factors of a networked value constellation [11, 49]. Ultimately, *each* actor involved should be able to make a sustainable profit and does so by interacting with the other organizations in the constellation.

Since there is no single type of interaction (e.g., information exchanges and economic value transfers are different kinds of interactions), e^3 *alignment* separates concerns by taking multiple perspectives on interactions between organizations in a constellation. Separating concerns is well known in the field of requirements engineering to deal with complex decision-making processes [8, 25]. e^3 *alignment* separates concerns by taking the following perspectives (see also Fig. 1):

– a *strategic* perspective, to understand the strategic influence of organizations on other organizations;
– a *value* perspective, to understand the things of economic value exchanged between the organizations in the constellation;
– a *process* perspective, to understand the order and activities behind the interactions;
– an *IS* perspective, to understand the IT enabled exchange of information between organizations.

The four perspectives in e^3 *alignment* are based on perspectives commonly found in business-ICT alignment framework such as the frequently cited Strategic Alignment Model [22].

By focusing on interactions, e^3 *alignment* takes an external view on alignment, also referred to as *inter-organizational alignment* [11]. Inter-organizational alignment is concerned with the coherence between actors in a constellation. In contrast, an internal view on alignment, or *intra*-organizational alignment, focuses on the alignment within a single organization [11], which is the main concern of most traditional business-ICT alignment frameworks (e.g., [18]). Inter-organizational alignment has two forms [11]: (1) alignment *within* one of the perspectives on interaction and (2) alignment *between* two, or more, of the aforementioned perspectives on interaction. Alignment *within* a perspective is concerned with aligning interactions between actors as seen from a single perspective [11]. For instance, Mobzilli has to align its information systems with the information systems from the actors in their networked value constellation. Alignment *between* perspectives is concerned with aligning multiple perspectives on the constellation at hand [11]. For instance, in the Mobzilli case, the value interactions have to be supported (e.g., aligned) with information interactions.

To illustrate e^3 *alignment*, we draw examples from the aforementioned Mobzilli case, but also from our cases in the Spanish electricity industry [32] and the Dutch aviation industry [33].

The paper is structured as follows: First, the case studies and research methodology will be introduced. Second, the e^3 *alignment* framework will be discussed. Hereafter, the modeling approaches used in e^3 *alignment* will be presented in more detail. Next, the process of alignment will be discussed and illustrated by means of

Fig. 1 The e^3 *alignment* framework
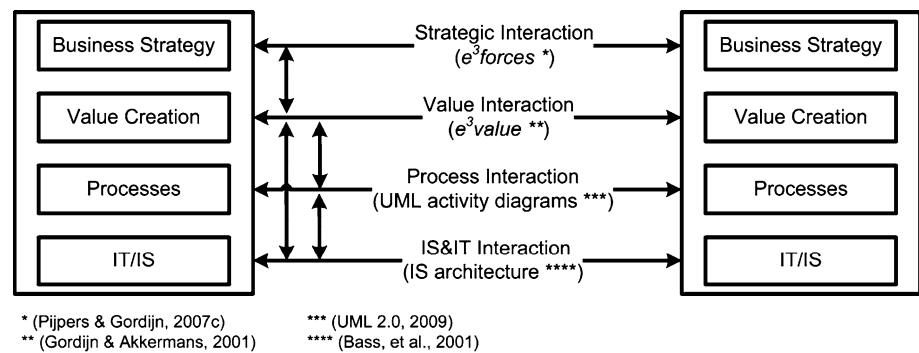
the case study. The paper ends with lessons learned and conclusions, in which we reflect on the practical usability of e^3 *alignment*, identify future research directions, and present conclusions.

2 Research methodology

2.1 Case studies

2.1.1 Mobzilli

Mobzilli is a starting business in the cross-section of the advertisement and the mobile telecommunication domain: the mobile advertisement domain. In recent years, new advertisement channels and models have emerged, redesigning the advertisement market (e.g., Google Ads). However, mobile communication as an advertisement platform is relatively new and opportunities for new businesses exist.

Key actors.

- *Mobzilli*, a starting business and the initiator of this networked value constellation. Mobzilli intends to offer *location-based advertisement* to various other organizations. Mobzilli has been founded in 2007 and hopes to expand to the whole of Europe within the upcoming years.
- *Merchants*, such as shops and restaurants, who need advertisement channels to promote their products/services. Mobzilli offers their location-based advertisement service to this group of organizations.
- *Potential Customers*. Mobzilli needs people who view the advertisements (i.e., potential customers); otherwise, the Merchants are not inclined to pay for the advertisement channel offered by Mobzilli. Customers are also important for Merchants, since in the end, this set of actors actually buys something (hopefully after seeing the advertisements).

The list of actors given is not exclusive. The design of Mobzilli's service and environment evolved over time, and actors will be replaced, added, or removed. These actors will be described accordingly.

Case: location-based advertisement. Mobzilli offers the service "location-based advertisement." The service consists of two parts. First, organizations (such as Merchants) are offered an innovative advertisement channel by virtually bounding their advertisements to geographical locations. Secondly, Potential Customers can view advertisements via a mobile phone app. So, if a customer is in a shopping center, she/he would be able to request the advertisements of the Merchants in her/his vicinity using her/his mobile phone. For customers, the service is free. Yet, Merchants who use Mobzilli's location-based advertisement channel must pay a small fee each time an advertisement is watched or choose a monthly subscription.

Stakeholder alignment problems. Mobzilli is faced with a number of alignment issues. To give a few examples:

- Mobzilli needs to determine a pricing model, meaning that it does not know what price to ask for its service or whehter it should be a fixed or variable price.
- Mobzilli needs to determine which technology to use to determine the position of customers (e.g., gps or gsm triangulation).
- Mobzilli needs to decide what business strategy to follow and how to execute this business strategy so that on the long-term Mobzilli will become a sustainable and profitable organization.

Case study interaction. For over a period of more than a year, we have had multiple interactive sessions with the founders of Mobzilli and were given access to their documents and systems. Because Mobzilli was in a incubator program of the European Space Agency, it had access to a large network of experts in the telecom industry (and we through them). In the beginning of this case study, we analyzed documents and used the sessions to determine the relevant artifacts for e^3 *alignment* in the context of a small starting organization. In the sessions hereafter, we jointly applied e^3 *alignment* to develop models, which provided a suitable starting point for further development of Mobzilli.

2.1.2 Spanish electricity

In Spain, electricity is generated by various sources including coal, hydro, gas, and nuclear power. Electricity producers and providers in Spain are among the largest in the world.

Key actors.

– *Consumers*, who consume electricity and pay for doing so.
– *Suppliers*, organizations which *provide* electricity to consumers. Suppliers acquire electricity at the electricity exchange operated by a market operator.
– *Producers*, organizations which *produce* electricity. From a legal point of view, producers and suppliers are separate entities.
– *Market operator*, called OMEL in Spain, the organization that controls the electricity exchange market. At this exchange market, suppliers and producers trade electricity. Depending on the offers and bids made by suppliers and producers, OMEL determines the final price of electricity for specific time frames. After the market is closed, suppliers and producers know how much electricity to supply and produce.
– *Technical system operator*, called REE in Spain, the organization responsible for the balance between supply and demand of electricity on a technical level. After OMEL has determined the price of electricity, REE validates whether the technical integrity of the electricity grid is not compromised.

Case: balancing supply and demand. In any electricity grid, the amount of electricity produced and consumed has to be equal. It is, however, impossible to know how much electricity is going to be consumed or produced. To this end, suppliers and producers work with projections. Projections are generally incorrect, causing "imbalance" between supply and demand. Imbalance has to be resolved by generating more or less electricity, which has to be paid for by the party causing imbalance. This "fine" is called an imbalance fee. The processes of resolving imbalance is controlled by REE.

Traditionally electricity was generated by large producers. Yet nowadays, smaller distributed energy resources (DERs) also exist (e.g., wind mills, solar panels or combined heat power devices). DERs, however, frequently cause imbalance (e.g., wind and sun are unpredictable), resulting in higher and more imbalance fees. Integrating DERs into the Spanish electricity grid is therefore not only a technical and operational challenge between multiple organizations but also a financial challenge (e.g., DERs have to be profitable).

Case study interaction. We have performed research in various EU programs for the electricity industry since 2000. The EU programs include Obelix and Fenix (for an overview best see http://www.e3value.com). In these projects, we have had an active role and helped stakeholders with solving various inter-organizational alignment issues. We have used this experience in our Spanish electricity case study. To do so, we visited Spain on multiple occasions to collect data, discuss artifacts, and apply e^3 *alignment*. Participants in these sessions often included IT and business managers from the key actors, but also experts in the field of electricity (from LABEIN for instance).

2.1.3 Dutch aviation

The Dutch aviation industry is one of the pillars of the Dutch industry. The airport Amsterdam Schiphol is ranked among the top 15 airports worldwide measured in the volume of passengers and goods transported. For the Dutch aviation industry to stay competitive, it is vital that the participating organizations jointly strive to improve operations and satisfy customer needs.

Key actors.

– *AAS* Amsterdam Airport Schiphol, the organization responsible for the exploitation of the Dutch airport Schiphol. AAS handles operations at Schiphol as soon as an airplane is at the gates and is also responsible for gate allocation.
– *KLM* KLM, Holland largest airliner and Schiphol's largest client. KLM is responsible for flying the plane and logistics concerning loading/unloading airplanes.
– *ATC NL* Air Traffic Control the Netherlands, responsible for the safe landing and take-off of airplanes at Schiphol. ATC is responsible for the logistics behind the inbound and outbound sequences of airplanes. ATC guides planes until they have arrived at a gate.

Case: Collaborative decision making. To compete worldwide, the organizations in the Dutch aviation strive continuously to improve operations. So it is also the goal of the collaborative decision-making (CDM) project. In the CDM project, KLM, AAS, and ATC intend to optimize inter-organizational processes, such that more value is created, by means of improved information systems and information system interactions.

Case study interaction. One of our researchers has been stationed for over 5 months at ATC NL in which contacts were made with stakeholders at ATC, KLM, and AAS to acquire data necessary for our research. The list of stakeholders is too extensive to list every individual, but the stakeholders included various IT and operational managers

from KLM, AAS, and ATC NL (and even the CEO of ATC NL). We conducted various interviews and interactive sessions with the stakeholders to (1) collect data for developing artifacts, (2) jointly create models, and (3) validate our findings.

2.2 Case study research

Unit of analysis: alignment in networked value constellations. The goal of our research is to determine how business and ICT can migrate from a "not aligned" state to an "aligned" state in the context of organizations operating in networked value constellations. Therefore, the unit of analysis in our research is inter-organizational business-ICT alignment.

Design, develop, and validate e^3alignment. Networked value constellations are complex entities [40]. To gain in-depth understanding of our subject of analysis, develop theories, and validate these theories, it is required to be part of the subject of analysis [45]. We followed a similar protocol for each of the case studies. As a first stage, we performed multiple interviews with relevant stakeholders to elicit possible relevant artifacts for inter-organizational business-ICT alignment. Subsequently, we used these artifacts to develop or improve e^3 *alignment*. Next, we validated e^3 *alignment* by analyzing inter-organizational business-ICT alignment in our case studies. This phase occurred during the projects described above. For example, one of the steps used in the Spanish electricity industry project was to elicit—and to resolve—inter-organizational business alignment issues. After our part of the projects was finished, we interviewed the various stakeholders again to determine the strength and weaknesses of e^3 *alignment* and made modifications accordingly.

Domain independent. e^3 *alignment*'s claims concerning inter-organizational business-ICT alignment are *not* domain dependent. To validate that e^3 *alignment* is domain independent, we have performed case studies in three very different domains. The Dutch aviation, Spanish electricity, and Mobzilli case each provide a unique setting, with unique inter-organizational business-ICT alignment issues. We selected these three case studies because they complement each other on various levels. For instance, Mobzilli is a starting business, whereas the Dutch aviation industry and Spanish electricity cases are concerned with large well-established industries. Furthermore, Mobzilli and the Spanish electricity cases require alignment because of *product* innovations, whereas the Dutch aviation case requires alignment because of *process* innovations (we discuss product & process innovation in more detail in Sect. 6). The variation in domains allowed us to test and validate that e^3 *alignment* is valuable for stakeholders in

various domains, without requiring any modifications to e^3*alignment*.

3 Inter-organizational business-ICT alignment

3.1 Business-ICT alignment

The term "business-ICT alignment" is widely used in both Management Information Systems (MIS) and Requirements Engineering (RE) literature, yet no single conceptualization exists. The most cited authors on this topic in MIS literature, Henderson and Venkatraman [18], conceptualize alignment as the integration between business strategy, ICT strategy, business infrastructure, and ICT infrastructure. Reich et al. [36] define alignment as the degree to which the goals of the business strategy are supported by the ICT strategy. Luftman [24] states that good alignment is applying appropriate ICT in given situations in a timely way and that this should be consistent with business strategy, goals, and needs. For an overview and description of these frameworks, see, e.g., Chan and Reich [7].

What the aforementioned conceptualizations have in common is that ICT is treated as a resource. According to the aforementioned authors, the focus should be on how ICT (in terms of goals and strategy) should be deployed to create alignment with the business. How ICT is designed in terms of functionalities is not considered a factor for creating business-ICT alignment.

In recent years, business-ICT alignment has become a relevant topic in requirements engineering also. Here, alignment is seen from a more formal point of view and is often described in terms of "consistency" [4]. Consistency is considered the correct semantic and formal relationship between business, often expressed in terms of needs and requirements, and ICT, often expressed in terms of functionalities and services. The general idea is that information system requirements can be derived from an information system's business context. Subsequently, if the needs of the business are properly met by ICT functionalities, then the business and ICT are aligned. Alignment frameworks from the field of requirements engineering include, among others, those developed by [1, 4, 19, 42, 43]. For an overview and description of these frameworks, see e.g., [39].

So, the focus of the conceptualizations of business-ICT alignment has shifted from a *strategical*, *conceptual* focus (e.g., [18]), where the purpose of both ICT and business are considered, to a more *operational*, *pragmatic* focus (e.g., TOGAF, [39]), in which ICT functionalities are designed to meet business needs. Still, all authors agree

that business-ICT alignment is about matching business and ICT as well as possible [7, 23].

3.2 Business-ICT alignment between organizations

Besides the described shift in focus of business-ICT alignment, there is another shift occurring. The described views on business-ICT alignment only consider a single organization [11]. Yet as stated, organizations increasingly operate in agile *networked value constellations*, requiring a focus on business-ICT alignment *between* organizations also (see e.g., [11, 19, 50]).

3.3 Inter-organization business-ICT alignment in e^3 *alignment*

Taken the shifts in conceptualization of business-ICT alignment into account, we conceptualize inter-organizational business-ICT alignment as "an interplay between business and ICT across multiple organizations, where business, ICT and organizations are dynamic and subject to change." Our view is consistent with the "operational" conceptualization of alignment, since we believe that cross-organizational business requirements should be met by IS functionalities. However, we believe the reverse to be true also; business should be designed such that the full potential of IS functionality is utilized.

3.4 Process of business-ICT alignment

So far we have discussed *what* business-ICT alignment is. Another key question is *how* to create inter-organizational business-ICT alignment [7, 23].

Creating business-ICT alignment is a complex process in its own right [7, 39]. To reduce complexity, the process is commonly divided into multiple phases, including a *design phase*, in which solutions to alignment problems are designed, an *implementation phase*, in which the solutions are actually implemented, and a *maintenance phase*, in which the implemented solutions are maintained.

In addition to these three phases, Yu [49] claims that an early phase, or *exploration phase*, should be performed. It is not uncommon that in the beginning of an alignment project, similar to any other innovation project, the project is surrounded by uncertainty [13]. Often, there is also limited information available [38]. To this end, it is not yet possible to completely understand the problem, to design detailed solutions, or to actually implement the solution. Choosing a solution direction too quickly at this stage brings the risk of being "locked in" (i.e., being bound to a certain solution path, while superior paths may exist) [13].

In the field of business-ICT alignment, choosing solution paths too quickly can result in situations where ICT is

not properly designed to meet the demands of the business, meaning that the ICT does function properly but does not meet the business needs [49]. It is also possible that the business fails to properly utilize the potential of ICT [15]. In such a case, the organization fails to design and implement a business (e.g., processes, structure), which commercializes ICT. As a result, the organization ultimately fails to generate revenues.

3.5 Alignment as a requirements engineering exercise in e^3 *alignment*

To assess and create business-ICT alignment during the exploration phase, we treat the "process of alignment" as a form of *requirements engineering*. Requirements engineering is concerned with eliciting and analyzing problems, and finding, implementing, and evaluating the solutions [25, 47].

Furthermore, an important aspect of requirements engineering is its multidisciplinary nature [14]. Requirements engineering acknowledges that different people are involved, each with a different background and view on the system to be developed. So for proper requirements engineering, multiple perspectives have to be taken [14, 25]—for example, a business and ICT perspective. From a requirements engineering point of view, these perspectives must represent the same system. Or in other words, the perspectives must be aligned [14].

4 The e^3 *alignment* framework

4.1 The e^3 *alignment* framework: an overview

To highlight the key features of the e^3 *alignment* framework, we present Fig. 1:

– The e^3 *alignment* framework focuses on *interaction* between organizations to create alignment in a networked value constellation. In Fig. 1, "interaction" is represented by the horizontal arrows.
– The e^3 *alignment* framework takes four different perspectives on interaction: a *strategic*, *value*, *process*, and *IS* perspective. For each perspective, there is a horizontal arrow in Fig. 1, representing the interaction between organizations considered by that perspective.
– The e^3 *alignment* framework explores and creates alignment between organizations *within* each perspective (the horizontal arrows in Fig. 1) and *between* the perspectives (the vertical arrows in Fig. 1).
– The e^3 *alignment* framework sees the process of alignment as a requirements engineering exercise. To this end, the e^3 *alignment* framework takes a conceptual

modeling approach to assess and create alignment within and between the four perspectives on interaction. For each perspective, a *conceptual modeling technique* is utilized. The conceptual modeling techniques are stated in the brackets per horizontal line in Fig. 1. The conceptual modeling techniques are discussed in the next section.

4.2 Interaction

We see networked value constellations as *nodes*, which are connected. In networked value constellations, the nodes are *actors* [40, 50]. Actors can be a variety of things such as organizations, but also individual persons or even pieces of hardware. In the Mobzilli case, actors include Mobzilli, mobile phone users, Merchants who want to display advertisements, and GPS satellites (which provide the position of users).

In networked value constellations, the "connection" between actors is "*interaction*." There is interaction between two actors when one actor influences the other [3]. Interaction between organizations in a networked value constellation implies that the organizations exchange objects (e.g., money, goods, information) [11]. For example, Consumers receive electricity from Suppliers, who in turn receive electricity from Producers.

Only when the interactions between the organizations are aligned—meaning the correct objects are exchanged, on the right time, from the right provider, and to the right receiver—will the constellation as a whole function properly [15, 20, 50]. For example, if Schiphol does not allocate gates on time, ATC does not know where to guide planes to, and subsequently, KLM is unable to properly connect their incoming and outgoing airplanes. To this end, we see correct *interaction* between organizations as the *key* requirement for inter-organizational alignment within a networked value constellation.

4.3 Multiple perspectives on interactions

As argued, the key concept of the e^3 *alignment* framework is interaction. Interaction is however a broad concept. In business literature, conceptualizations range from supply chain literature where objects of value are exchanged between actors [20] to strategic literature where actors influence each other on a strategic level [34]. In computer science, literature interaction is often considered from an information viewpoint where information is exchanged between actors [46] or a process viewpoint where the sequence of interactions is the main focus [44].

In the field of business-ICT alignment, it is well accepted not only to differentiate between "business" and "ICT" but also to take multiple perspectives into account. For instance, the most influential alignment framework, the Strategic Alignment Model (SAM) created by [18], takes four perspectives into account: "Business strategy," "Organizational infrastructure and processes," "ICT strategy," and "IT infrastructure and processes." Taking multiple perspectives on an organization, or a system, is also well known in IS development [25, 39]. The rationale is that each perspective analyzes a different aspect of the organization, thereby separating concerns. The benefit of separating concerns is that (large) complex issues are reduced to more comprehensible issues, making it easier to focus on the key elements [25].

So, to separate alignment concerns, the e^3 *alignment* framework takes four perspectives on an interaction in networked value constellations: a Business Strategy perspective, a Value Creation perspective, a Business Processes perspective, and an Information Systems & Information Technology perspective.

4.3.1 The four perspectives in e^3 alignment

Business strategy perspective on interaction. The Business Strategy perspective, in short "strategic perspective," considers how organizations *influence* each other on the long-term (i.e., interact). "Influence," within the strategic perspective, is the extent to which organizations can determine the configuration (including price) of objects and resources needed from and provided to other organizations [34, 50].

Assume that Mobzilli develops mobile applications for Apple's iPhone. If Apple would change the regulations and specifications for applications (which it frequently does), Mobzilli would have no other choice but to comply. It is because Apple possesses a monopoly on iPhone applications, and Mobzilli is only one of the many developers. Traditional business literature dictates that key actors (such as Apple) can relatively easily make demands to the configuration of a product (which Apple frequently does) [34].

Value creation perspective on interaction. The Value Creation perspective, in short "value perspective," considers how *value* (i.e., money) is created by the networked business. The networked business creates value to meet the need of end-consumers. To this end, the organizations in the networked business exchange objects of value with each other. For instance, Mobzilli provides customers with a small application, for which the customers pay a small fee. Therefore, within the value perspective, "interaction" is the exchange of value objects between at least two actors.

The value perspective is a relative new perspective in the field of requirements engineering. Yet the financial side

of a networked business is a key aspect to consider. The organizations in the networked business have to be financially feasible; otherwise, they will not survive in a competitive business environment [11, 15]. The financial feasibility of an organization depends on a proper business strategy, execution of business processes, and deployment of ICT. How value is created should therefore be one of the key business requirements to consider.

Business processes perspective on interaction. The business processes perspective, in short "process perspective," considers the business processes that organizations have to execute to interact with each other. In contrast to the other perspectives, the process perspective takes "time" into consideration and focuses on the *physical* exchanges of objects. Within the process perspective, "interaction" means the physical exchange of objects within the constraints of time.

Information system perspective on interaction. The information system perspective, in short "IS perspective," focuses on information exchanges between organizations, but also on information systems and technologies used to facilitate the information exchanges. For example, Mobzilli has an application that requires customers to send their location to Mobzilli, who in return sends data to the customers' mobile phone. Subsequently, "interaction" within the IS perspective is the exchange of information between organizations/actors.

4.3.2 Interaction as a common denominator

Another reason why we take these four perspectives is that current alignment frameworks offer limited insight into the in-depth relationship between perspectives (cf. [7]). We claim that this is because the perspectives considered by other frameworks do not have a common denominator. Although concerns are separated over perspectives, the perspectives analyze very distinct aspects of an organization, making it hard to relate the perspectives. For instance, within the Strategic Alignment Model by [18], the "ICT Strategy" perspective considers the "technology scope," whereas the "Business Process" perspective considers the "administrative infrastructure," yet how these two perspectives are exactly related remains unclear. Without properly understanding the relationships between the perspectives, it is difficult to actually create alignment [7].

The e^3 *alignment* framework is not limited by the aforementioned issue because the e^3 *alignment*'s perspectives have a common denominator: "*interaction.*" In each perspective, we focus on one particular type of interaction; subsequently, it is easier—as we will demonstrate later—to understand the relationship between the perspectives and ultimately create alignment between the perspectives.

Besides creating more insight into the relationships between the perspectives in the e^3 *alignment* framework, consequently focusing on *interaction* allows us to create one *coherent* design of all the perspectives for the constellation at hand. Since the e^3 *alignment* framework should be used in the exploration phase of inter-organizational alignment, our coherent design results in a suitable starting point for later phases of requirements engineering.

4.4 Alignment of interactions

Taking multiple perspectives in an inter-organizational alignment setting means that we need to create not only alignment *within* each of the perspectives (*inter-organizational* alignment), but also alignment *between* the perspectives (*business-ICT* alignment). Therefore, we distinguish two types of alignment: inter-organizational alignment *within* a perspective and inter-organizational alignment *between* perspectives.

4.4.1 Alignment within a perspective

Alignment *within* a perspective is concerned with alignment between organizations as seen from a *single* perspective. For example, in the Dutch aviation industry, KLM, AAS, and ATC have to work together to bring airplanes in, unload, and load the airplanes and send them off again. This is called the turnaround process. Each actor performs a specific set of processes to complete the turnaround process. The turnaround process can be successful only if the processes of all organizations are properly aligned (e.g., occur in the correct order and at the right moment). As the examples show, for a value constellation to function properly, alignment of interactions within perspectives is required [11, 15, 50].

4.4.2 Alignment between perspectives

Inter-organizational alignment *between* perspectives is concerned with alignment between perspectives taken on the constellation at hand [11]. Consider for example the Spanish electricity case. DERs such as windmills and solar cell now produce electricity also. To utilize their electricity, DERs have to be integrated on a technical level (e.g., connected to the power grid). But DERs also cause imbalance (inequality between supply and demand). If a DER is responsible for imbalance, it (or its owner) has to pay an imbalance fee, increasing the costs of DERs significantly. So the challenge is to find a solution that integrates DERs on a technical level but also ensures that the DER is financially feasible (e.g., does not cause too much imbalance, which requires technical solutions).

Since the e^3 *alignment* framework takes four perspectives on interaction in constellations, all four perspectives need to be aligned.

4.4.3 Alignment between strategic and value perspectives

In essence, alignment between the strategic and value perspectives means that the short-term value creation is strategically desired (i.e., beneficial on a long-term). The value perspective analyzes what value is exchanged between organizations in a networked value constellation to determine the profitability of organizations. This interaction (the exchange of value objects) is however viewed from a *short-term* perspective [15]. The value interactions between organizations can also be viewed from a *long-term* perspective, which is what the business strategy perspective does. The long-term strategic effects of the value exchanges determine the strategic position of an actor. A proper strategic position is crucial for the execution of an organizations's business strategy and thus for the organization's long-term survival [34].

We discuss the alignment between the value and strategic perspectives in more detail in Sect. 5, but in short alignment between the value and strategic perspectives implies that (1) the *strategic position* of the organizations in the constellation does not conflict with their business strategies, (2) the strategic position of the organizations is the result of their value interactions, and (3) all the organizations in the constellation are profitable as a result of the value interactions.

4.4.4 Alignment between value and process perspectives

In essence, alignment between the value and process perspectives means that the execution of processes leads to value creation. In contrast to the value perspective, which analyzes on a conceptual level what value is exchanged between actors, the process perspective analyzes how these exchanges are realized in the physical world. Furthermore, in contrast to the value perspective, the process perspective takes time into account. So in the process perspective, it is possible to determine the order of exchanges and to determine whether organizations are able to exchange objects.

We discuss the alignment between the value and process perspectives in more detail in Sect. 5, but in short alignment between the value and process perspectives implies that (1) each organization in the networked value constellation is profitable, (2) each organization is profitable because processes are executed and objects are exchanged in the physical world, and (3) the actors are able to execute the processes and are able to do so in the correct order.

4.4.5 Alignment between value and IS perspectives

In essence, alignment between the value and IS perspectives means that the value creation is supported by information systems, including technologies used. Choices for certain types of technologies can have financial consequences, implying that new technologies influence the creation of value, either through higher/lower costs or through more value creation. Furthermore, the structure (or architecture) of information interactions can influence how value is created. For instance, if there is a centralized IS architecture (e.g., one large central server where valuable information is stored), then the value structure is often similar (e.g., the value resides at the organization owning the server).

We discuss the alignment between the value and IS perspectives in more detail in Sect. 5, but in short alignment between the IS and process perspective implies that (1) the organizations in the constellation are profitable, (2) the value interactions of the organizations are supported by information systems, which enable information exchanges supporting the value interactions, and (3) each organization receives all information needed from other actors and provides all information required by other actors.

4.4.6 Alignment between the other perspectives

As stated, all four perspectives in the e^3 *alignment* framework need to be aligned. However, we only intend to create alignment between the perspectives as presented in Fig. 2. We do consider alignment between the process and IS perspective. However, since enough research has been done in this area (see e.g., [22, 43]), we did not research this relationship (i.e., the line is dashed). In addition, we do not directly align the strategic perspective and process respectively IS perspective. Instead, we align the strategic perspective and process respectively IS perspective via the value perspective. We do so because of the conceptual gap between the strategic perspective and process respectively IS perspective. For instance, in the Mobzilli case, we tested whether creating alignment between the strategic and IS perspective directly was easier and better understandable than via the value perspective. Stakeholders confirmed that the conceptual gap between the strategic and IS perspective is hard to understand (e.g., how is satellite technology related to a "differentiation" business strategy) and that this gap can be filled via the value perspective. We discuss this in more detail in Sect. 6 (for more information, see also [30]).
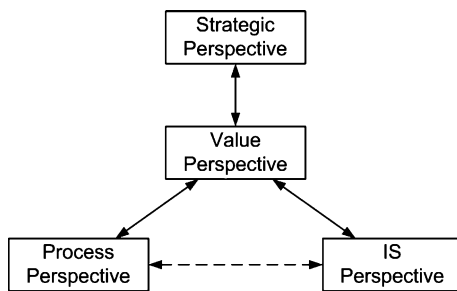
Fig. 2 The value perspectives connects the other perspectives

4.5 Process of alignment

4.5.1 Alignment as an iterative cycle

As stated, we treat the process of alignment as a requirements engineering exercise. A naive way to reason about requirements engineering is to expect a top-down or "waterfall" approach, believing that we start at one perspective and end at another perspective. The world, including the competition, is continuously changing in terms of enterprises, services, and technologies. Therefore, we consider the process of alignment as a complex and continuous activity, for which a structured approach is needed.

A commonly used approach for requirements engineering is the engineering cycle proposed by [47]. The engineering cycle describes six nonlinear steps: problem investigation, solution design, solution validation, solution selection, solution implementation, and implementation evaluation. e^3 *alignment* is however designed for the *exploration phase*, which takes place before the engineering cycle [49]. We use the engineering cycle as the foundation of our process of alignment and extend the engineering cycle with an exploration cycle consisting of the following three steps:

1. *Elicit alignment problems*, in which we *explore* the networked business at hand on business problems within and between perspectives. The "elicit alignment problems" step is comparable to the problem investigation step found in the engineering cycle.
2. *Design alignment solutions*, in which we search for and design various business solutions for the identified alignment problems. The business solutions found will result in the business requirements. The "design alignment solutions" step is comparable to the solution design step found in the engineering cycle.
3. *Analyze alignment solutions*, in which we explore the impact of the proposed solutions. Exploring the impact of a solution to a problem may lead to new or refined problems, because thinking about the problem leads to better understanding of the problem. The "analyze

alignment solutions" step is comparable to the solution validation step found in the engineering cycle.

We demonstrate e^3 *alignment*'s exploration cycle with examples from our case studies in detail in Sect. 6.

4.5.2 Alignment with conceptual models

Besides a structured approach for the process of alignment, practitioners need "tools" for the process of alignment [7]. Traditionally, requirements engineering was mainly concerned with functional specification, using techniques such as "Z" [17]. However, to capture the semantics of the domain in which information systems operate, including the business context, a different approach is often used: *conceptual modeling* [17]. Conceptual modeling is concerned with providing symbol structures and manipulators, which correspond to humans' interpretation of the world around them [5]. Conceptual models also allow for formal specifications that can be used for automated analysis.

Since conceptual models allow us to analyze and design both information systems and their business context, we use *conceptual modeling techniques* as "tools" to assess and create inter-organizational business-ICT alignment. A key advantage of using conceptual models is that complex analyses can be done in a light-weight fashion. This makes conceptual models suitable for the exploration phase of inter-organizational alignment [15, 49].

This notion is supported by case study results. Often only a few sessions with stakeholders were necessary to create meaningful conceptual models. In addition, with conceptual modeling techniques, it is easy to create shared understanding among stakeholders over various aspects of the networked value constellation at hand [6]. This is also confirmed by findings from our case studies, because stakeholders considered the models valuable and actually used them to explain case aspects to other people.

Because the e^3 *alignment* framework takes four perspectives on the organizations at hand, a conceptual modeling technique is needed for each perspective. For the strategic perspective, we utilize e^3 *forces*; for the value perspective, we utilize e^3 *value*; for the process perspective, we utilize UML activity diagrams; and for the IS perspective, we utilize IS architectures. The conceptual modeling techniques are discussed in more detail in the next section.

5 Conceptual modeling

As stated, e^3 *alignment* utilizes four different modeling techniques—e^3 *forces*, e^3 *value*, UML activity diagrams, and IS architectures—one for each perspective. The

modeling techniques have to be aligned accordingly to the alignment of e^3 *alignment*'s perspectives as described in Sect. 4.4. Since e^3 *forces* and e^3 *value* are lesser known, we first shortly discuss both conceptual modeling techniques in the next two subsections.

5.1 e^3 *forces*

We use e^3 *forces* (see [28]) to elicit business requirements regarding the strategic perspective. The e^3 *forces* technique provides modeling constructs for representing and analyzing strategic-related concepts, such as "strategic position" and "business forces." It enables practitioners to analyze the strategic position of an organization by analyzing the influence of environmental business forces on a product/service offered by the actor under investigation. In the case of an organization participating in a networked value constellation, the other organizations in the constellation are considered environmental business forces.

The business forces analyzed are directly based on Porter's Five Forces framework [34, 35]. In an e^3 *forces* model, business forces and their strength are explicitly stated and are related to actors (see Fig. 3 for example). Furthermore, e^3 *forces* enable practitioners to quantify business forces' strength such that it is possible to compare various alternative strategic positions. Finally, e^3 *forces* provide a clear and compact graphical overview of an organization's strategic position and related environmental business forces. The e^3 *forces* technique uses the following constructs:

Actor. Actors are independent economic (and often also legal) entities [20]. Actors operate independently or as part of a constellation, which is a coherent set of two or more actors who cooperate to create value to their environment [41]. *Properties:* An actor has a predetermined *business strategy*. The business strategy of an organization is the direction and scope of the organization's configuration and

position in its environment such that it creates competitive advantage [20, 34]. For an organization to successfully execute its business strategy, a matching strategic position must be chosen [35]. Three generic strategies are considered [20, 34]: (1) *cost-leadership*, which is trying to offer value objects with similar quality as competitors but with a lower price; (2) *differentiation*, which is to offer value objects with qualities that are unique or differ from competitors; (3) *focus*, which is focusing on a specific (small) buyer market. *Relationships:* An actor, or constellation, acquires and offers value objects from and to an environment consisting of business forces [20, 34]. *Representation:* An actor is modeled as a square.

Business force. Business forces are those organizations that operate in the *environment* of the actor under study. From a modeling perspective, a business force is not an independent organization but a set of organizations called *market*. These external organizations are grouped in markets because by considering sets of organizations, we abstract away from the individual and limited influence of many single organizations [34]. This abstraction simplifies the e^3 *forces* models to be made and suffices for the business forces analysis we conduct. Therefore, we consider relationships between actors and specific markets in the actor's environment, rather than the many relationships between actors and each individual organization in the actor's environment. *Relationship:* Business forces *influence* the price and/or configuration of value objects, which they acquire from or offer to actors [20, 34]. They are able to do so because they negotiate different prices, bargain for higher quality, alter specifications, or try to play competitors against each other [34, 35]. *Properties:* A business force, or market, has a certain *strength*. The strength of a force indicates to what extent that specific force can *influence* the price and/or configuration of a value object offered to or acquired from an actor. *Representation:* A business force or market is modeled as a layered square. The strength of a business force is expressed by a "strength" arrow. A strength arrow is graphically bundled with the exchange of a value object and points from the business force toward the actor.

Types of business forces: buyer markets. Buyers markets are sets of organizations, which are part of the environment of an actor and acquire value objects from the actor under study. Buyer markets can influence value objects because they negotiate down prices, bargain for higher quality, and desire different specifications [34, 35]. All this is at the expense of the profitability of actor under study [34, 35]. Note that we, as described above, do not look at buyers independently; instead we analyze the buyer *market* of which the individual buyer is a part. After eliciting buyer markets, the next step is determining the strength of buyer markets. To determine the strength of buyer markets, we
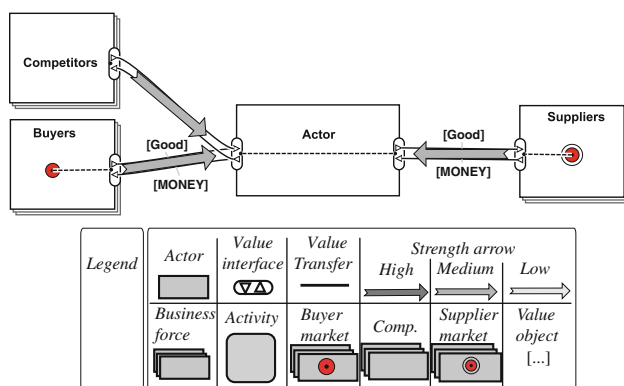
Fig. 3 e^3 *forces*: example

have developed a metric based on Porter's [34] original buyer market analysis.

Supplier Markets. Supplier markets, the second business force, are those organizations that provide value objects to actors in the constellation. Suppliers influence value objects provided to actors in a constellation by threatening to alter the configuration of value objects, to increase the price, or to limit availability of value objects [34]. All this is at the expense of the profitability of the actor under study [34, 35].

Competitors. An additional force is exercised by *competitors*—actors that operate in the same industry as the constellation and try to satisfy the same needs of buyers by offering the same value objects to buyer markets as the constellation does [20]. Competitors are a threat for actors because they try to increase their own market share, influence prices and profits, and influence customer needs; in short, they create competitive rivalry [34, 35]. Due to space limitations, we consider "substitutes" and "New Entries" as competitors, which is motivated by the fact that they also try to satisfy the same customer needs.

Value object. Markets and actors in a constellation exchange products and services that are, in generic terms, *value objects* [16]. A value object has economic value for an actor when the actor can use the object to satisfy a need or when the actor can use the object to transfer with another object [16]. *Properties:* A value object has two attributes [20, 34]: (1) the *configuration* consisting of the qualities the object offers and (2) a *price* that is expressed in terms of another value object, wanted in return by the provider of the original value object (the price to be paid is usually money, although not obligatory). *Relationships:* The price and/or configuration of value objects acquired/offered by an actor from buyer and supplier markets are influenced by environmental business forces.

Strength of business forces. To analyze the influence of a business force on a value object, Q_j different aspects need to be analyzed depending on the business force [28, 35]. For buyer markets, 7 aspects need to be analyzed; for supplier markets, 5 aspects need to be analyzed; and for competitor markets, 7 aspects need to be analyzed. These aspects are directly derived from the Five Forces Model (see [28, 35]). To be able to measure and compare the strength of the business force, each of the business aspects related to the business force is scored on a five-point scale. The scoring of business aspects is performed with the aid of *domain experts*. This method of scoring is based on grounded business theories (e.g., Balanced Score Cards [21]) and software architecture theories (e.g., CBAM [2]). The score "5" indicates that the extent to which the business force can influence the value object exchanged is high, and "1" indicates that it is low. Because the relevance of the aspects can vary per value object exchanged, domain

experts give each aspect a *weight factor* (β_j), as done in CBAM [2]. The domain expert has to divide 100 points over the *n* aspects ($\sum_j^n \beta_j = 100$); more points indicate higher relevance. When the weighted expert scores are summed, the "strength" of a business force in relationship to the exchanged value object is expressed. The strength of a business force indicates to what extent the business force is able to influence the value objects exchanged with the actor in the networked value constellation.

$$\text{Strength}_{\text{business force}} = \left(\sum_j^n \beta_j * Q_j \right) / 5$$

The total sum is divided by 5 to range buyer market's strength from a maximum of "100" to a minimum of "20." For *visual* purposes, a score in the range of "20–48" indicates low strength (light gray arrows), "48–76" indicates medium strength (medium gray arrows), and "76–100" indicates high strength (dark gray arrows).

5.2 e^3 *value*

To elicit business requirements regarding value interactions, we utilize the e^3 *value* modeling technique. The e^3 *value* modeling technique provides modeling constructs for representing and analyzing a network of organizations in which value objects are transferred. For more information see [15, 16]. We summarize e^3 *value* below, with the aid of an example (see Fig. 4).

Actors are perceived by their environment as economically independent entities, meaning that actors can take economic decisions on their own. *Value objects* are services, goods, money, or information, which are of economic value for at least one of the actors. Value objects are exchanged by actors. *Value ports* are used by actors to provide or request value objects to or from other actors. *Value interfaces* are owned by actors, group value ports, and show economic reciprocity. Actors are only willing to offer objects to someone else if they receive adequate compensation in return. Either all ports in a value interface each precisely exchange one value object
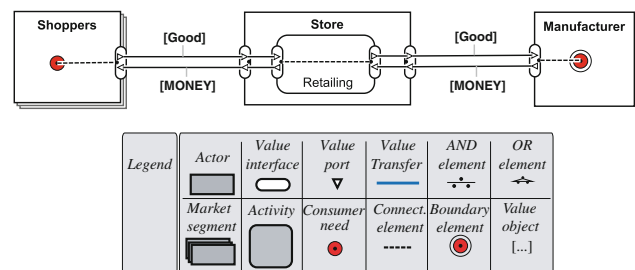

Fig. 4 e^3 *value*: example

or none at all. *Value transfers* are used to connect two value ports with each other. It represents one or more potential trades of value objects. *Value transactions* group all value transfers that should happen, or none should happen at all. In most cases, value transactions can be derived from how value transfers connect ports in interfaces. *Value activities* are performed by actors. These activities are assumed to yield profits. *Dependency paths* consist of *consumer needs*, *connections*, *dependency elements*, and *dependency boundaries* and are used to reason about the number of value transfers. A consumer need is satisfied by exchanging value objects (via one or more interfaces). A connection relates a consumer need to a value interface or relates various value interfaces of the same actor internally.

5.3 Aligning the strategic and value perspectives

Since we use e^3 *value* to analyze the value perspective and e^3 *forces* to analyze the strategic perspective, we address alignment between the e^3 *value* and e^3 *forces* modeling techniques. From various case studies performed (see [27, 28]), we know that we have to compare the e^3 *value* and e^3 *forces* model on the following aspects:

- **Each business force in the e^3 *forces* model can be mapped to an actor/market in the corresponding e^3 *value* model**. We determine whether the actors and market segments in the e^3 *value* model, which directly interact with the actor(s) under investigation, are represented as business forces in the e^3 *forces* model. If not, there is an alignment issue between the strategic and value perspectives. This however does not hold for "competitors," since there is no equivalent to "competitors" in the e^3 *value* model.
- **The value transactions in the e^3 *forces* model have an equivalent value transaction in the corresponding e^3 *value* model**. We also compare the value transactions in the e^3 *value* model and e^3 *forces* model. If an actor/segment exchanges value objects with the actor under investigation in the e^3 *value* model, then there should be an equivalent value transaction between the same actor and the corresponding business force in the e^3 *forces* model. If not, the strategic and value perspectives are not aligned.

If the e^3 *value* model and e^3 *forces* model are correct on the aforementioned issues, then both models are properly aligned. And as stated, if the e^3 *forces* model and e^3 *value* model are aligned, then the value and strategic perspectives are also aligned. Note that we make the assumption that there is correct inter-organizational alignment within the strategic and value perspectives.

5.4 Aligning the value and process perspectives

Since we use e^3 *value* to analyze the value perspective and activity diagrams to analyze the process perspective, we address alignment between e^3 *value* and activity diagrams. From various case studies performed (see [26, 29, 48]), we know that we have to compare the e^3 *value* model and activity diagram on the following aspects:

- **All actors/segments in the e^3*value* model have an equivalent "swimlane" in the corresponding activity diagram**. We determine whether the same actors are presented in both the e^3 *value* model and activity diagram (seen as swim lanes). If not, then the value and process perspectives are not properly aligned.
- **The value transactions in the e^3 *value* model can be mapped to a set of object exchanges in the corresponding activity diagram**. We determine whether value transactions in the e^3 *value* model are correctly represented in the process model. If in an e^3 *value* model, actor A transfers an object to actor B, then an equivalent object should be transferred, possibly via other actors, from actor A to actor B in the corresponding activity diagram. If not, then there is incorrect alignment between the process and value perspective.

If the e^3 *value* model and activity diagram are correct on the aforementioned issues, then both models are properly aligned. And as stated, if the e^3 *value* model and activity diagram are aligned, then the value and strategic perspectives are also aligned.

5.5 Aligning the value and IS perspectives

The relationship between the value and IS perspectives is less straightforward than the relationship between the value and strategy perspectives or relationship between the value and process perspective. Our research findings indicate that information abstracted from an e^3 *value* model can be used to explain elements in an IS architecture, and vice versa. For instance, the set of actors in an IS architecture is a subset of the actors in the corresponding e^3 *value* model. However, which actors should be included in the IS architecture is case dependent. Also, technologies used in the IS architecture affect the set of actors and value transactions in the e^3 *value* model. Yet again, this is also case dependent.

Since we operate within the exploration phase of inter-organizational alignment, we do not strive to create complete formal consistency between the various models. We are only interested in determining whehther the perspectives are aligned. The combination of domain knowledge (via domain experts) and expert knowledge on e^3 *value* models and IS architectures allows us to do so. We assess

static alignment between the value perspective and IS perspective by determining the following factors:

– **The actors in the IS architecture are a subset of the actors in the corresponding** e^3 *value* **model**. If an actor is not in the IS architecture, then a suitable explanation should be found. Otherwise, the actor should be added to the IS architecture to create alignment. Consider the Mobzilli case, where the actor Telecom Provider is included in the e^3 *value* model, but not in the corresponding IS architecture. The reason is that although information technically is exchanged via the Telecom Provider, this is trivial knowledge and subsequently omitted from the IS architecture.

– **The information exchanges can be linked to a value transfer in the corresponding** e^3 *value* **model**. Each information exchange in the IS architecture has to be part of a value transfer. For instance, the information exchange "advertisements" between Merchants and Mobzilli is part of the value transfer "Adv. Channel." So basically, we try to determine whether we can relate each information exchange to a value transfer. If this is not possible, we determine whether the information exchange implies that a value transfer should be added to the e^3 *value* model, or whether the information exchange should be omitted from the IS architecture.

If the e^3 *value* model and IS architecture are correct on the aforementioned issues, we assume that both models are aligned from a point of view at higher level . And as stated, if the e^3 *value* model and IS architecture are aligned, the value and IS perspectives are also aligned.

6 Process of inter-organizational business-ICT alignment

As discussed, we see the process of business-ICT alignment as the execution of a requirements engineering exploration cycle, consisting of the following three steps: (1) to elicit alignment problems, (2) to design alignment solutions, and (3) to analyze alignment solutions. Applying these three steps is, however, more complex in real life as we demonstrate with the findings from our case studies in the next section.

6.1 Outline e^3 *alignment*'s exploration cycle

In Fig. 5, we present an outline for the e^3 *alignment*'s *exploration cycle*. The three aforementioned exploration steps should be performed in a continuous cycle until a satisfiable result is reached (which is determined by the stakeholders). However, we first need to know where to start.
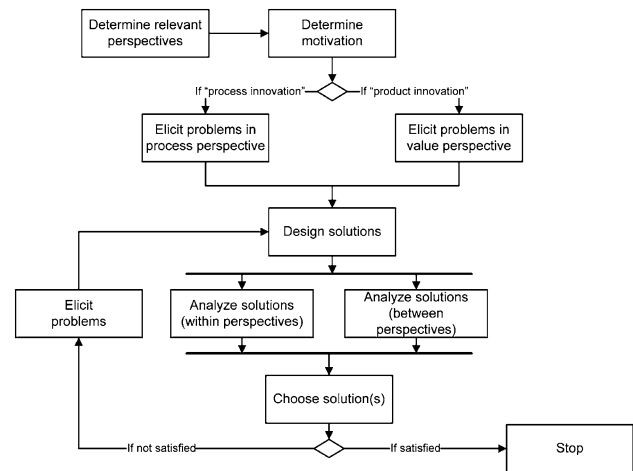

Fig. 5 The e^3 *alignment* process outline

The first two steps presented in the outline, "*determine relevant perspectives*" and "*determine motivation for alignment*," are preconditions. The results from these two steps are required to determine where to start the e^3 *alignment* process. Because they are preconditions, we refer to these two steps as "step 0." We go into more detail of these two preconditions in the next section.

After we have determined which perspectives to take into account and why alignment is needed, we start with eliciting alignment problems in either the process or value perspective. Hereafter, we design solutions for the problems identified. Next, we analyze the solutions for their impact on alignment within the perspectives and alignment between the perspectives. After this step, there is a choice for the stakeholders: continue with the e^3 *alignment* cycle or stop. In the next sections, we will illustrate these steps with examples from our case studies.

6.2 Preconditions

The first steps in the e^3 *alignment* cycle are (1) to determine which perspectives are of key interest to the stakeholders and (2) to determine the motivation for eliciting business requirements.

6.2.1 Determining relevant perspectives

In the e^3 *alignment* framework, four perspectives are considered; however, case study experience shows that not always all perspectives are relevant. Which perspectives are relevant depends on the case and stakeholders. To avoid unnecessary activities, we suggest to predetermine the desired perspectives.

Relevant perspectives for our case studies. At this point, in their development, the stakeholders of Mobzilli are *not* interested in the processes needed to offer their service.

Mobzilli's key concerns are with finding a design for their IS architecture (e.g., which technologies to use?), their business model (e.g., how to create value?), and business strategy (e.g., how to survive in the long run?). Subsequently, the IS perspective, value perspective, and strategic perspective are of interest to Mobzilli's stakeholders.

In the Spanish electricity case study and the Dutch aviation case, the actors were not interested in strategic considerations. In both cases, the actors acknowledged the importance of strategic considerations (this was also the reason why the CEO of ATC NL was involved), but for both projects, strategic considerations were placed outside the scope of the project.

6.2.2 Determining motivations for alignment

There are various reasons why we need to create inter-organizational alignment. We differentiate between the following two: *process innovation* and *product innovation* [13].

– *Process innovation*. According to traditional business-ICT alignment frameworks, organizations should strive for alignment to improve their performance [7]. Such improvements are referred to as *organizational process innovations* [12, 37]. Organizational process innovation in the broadest sense can be seen as innovation on the business side of the organizations, ranging from modifying processes to changing the entire business structure [12]. Process innovation can be a motivation for inter-organizational alignment, because aligning the business and ICT results in new and better ways of doing things (e.g., process optimization). This was exactly the motivation for the actors in the Dutch aviation case. Their main motivation was to optimize cross-organizational operation by improving their inter-organizational business-ICT alignment.

  If process innovation is the key motivation, then the first step of the e^3 *alignment* process is to elicit inter-organizational alignment issues in the *process perspective*.

– *Product innovation*. The second motivation for alignment is "*product innovation*." Product innovation starts with a technological invention. An invention is the first occurrence of an idea for a new product/service [13] and nowadays is often information technology driven. Commercialization of inventions results in "*product innovation*" [37]. To commercialize the invention, not only the invention must is technically realized, but also a proper business plan is needed [15]. This was exactly the motivation for the actors in the Spanish electricity industry; new innovations (DERs) needed to be properly commercialized. Mobzilli's motivation for eliciting business requirements is

"product innovation" also, because Mobzilli's new service is considered an invention that needs to be commercialized. Subsequently, we start with exploring the value perspective.

If product innovation is the key motivator for alignment, then the first step in the e^3 *alignment* process is to explore how the new product/service creates value. Subsequently, the first step would be to explore the *value perspective* on inter-organizational alignment issues.

7 Using e^3 *alignment* in real-life case studies

To illustrate e^3 *alignment*, including its conceptual models and process of alignment, we provide examples from our case studies in the next sections. From each case study, we show a specific part of the entire e^3 *alignment* process we have applied in the corresponding case study.

7.1 Dutch aviation: optimize processes

Step 1: Problem elicitation. We begin e^3 *alignment* and start eliciting problems with the aid of UML activity diagrams (see Fig. 6a). The presented activity diagram is modified to highlight examples of two specific inter-organizational alignment problems (the round circles):

Different language. The organizations in the Dutch aviation use different terminologies for the states of the airplanes. In the process model, this is highlighted by the top circle. For instance, the estimated time of arrival of an airplane ("ETA(1)" and "ETA(2)") has different *notations* and *valuations* across the actors. The ETA can be the moment the plane lands, the moment the airplane is at the gate, or the moment the passengers depart from the airplane. As a result, the arrival time of an airplane varies per actor, which can lead to confusion between the actors.

Order of processes. There are problems regarding the order and time frame in which information is exchanged in the Dutch aviation. Information is often provided by organizations last minute. Because an organization's planning depends on information provided by other organizations, it is difficult for an organization to make correct logistic plans if the data are provided last minute. In the process model, this is highlighted by the bottom circle. For instance, if KLM holds a plain "In Block," then the new "Off Block Time" is shared with ATC after ATC has made an outbound sequence for the departing airplanes. This indicates that the order of processes is incorrect, or at least not optimal.

Step 2: Design solutions. In the outline in Fig. 5, we see that the next step is to design alignment solutions for the
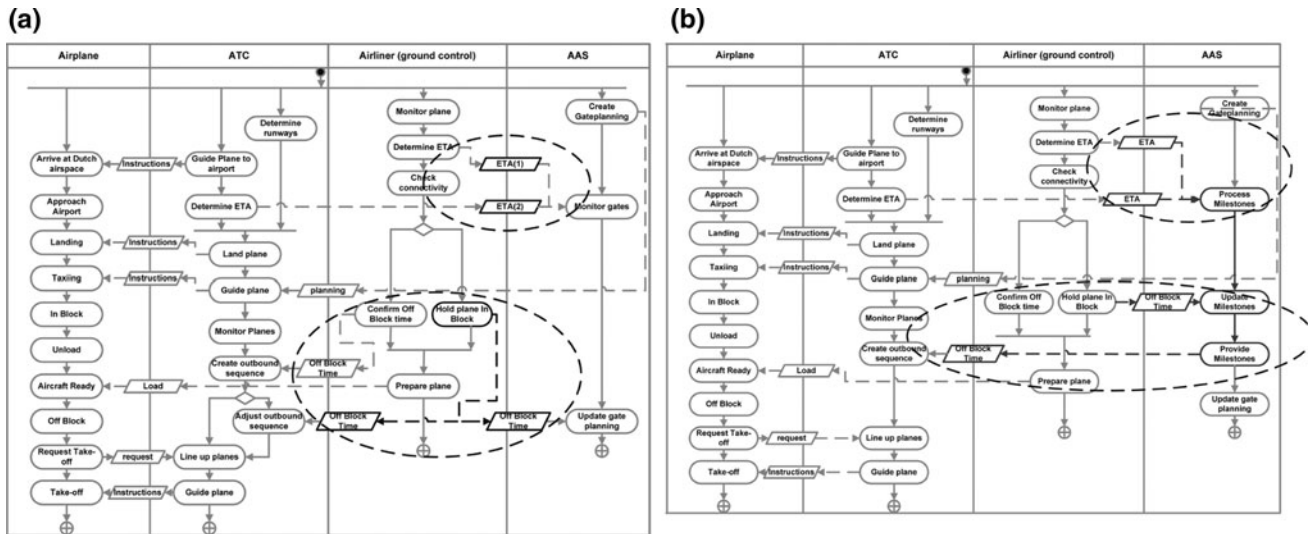
Fig. 6 UML activity diagrams

problems identified in the previous step. For the Dutch aviation case, the following solutions were found:

Milestone approach. The first problem was that each organization uses its own terminology for the states of an airplane during the turnaround process. The solution is a common terminology for the various states of an airplane during the turnaround process (e.g., landing, in-gate, departure) called the "Milestone" approach. Furthermore, the Milestone solution includes that the valuation for each stage of the plane is the same across all actors. For each moment, the valuation of one of the actors is leading. In the activity diagram in Fig. 6b, this is highlighted by only one form of "ETA" being sent to AAS (top circle).

Single point of information. The solution to the second problem (untimely information sharing) is centralizing all information, relevant for the turnaround process, into a single actor. One actor is going to (timely) gather all information concerning the various states of airplanes. Furthermore, this actor will distribute the, now-accurate and up-to-date, information among the other actors. In the activity diagram in Fig. 6, this is highlighted by the "off block time" being distributed via AAS (bottom circle).

Step 3: Analyzing alignment solutions. Following the outline presented in Fig. 5, the next two parallel steps are to analyze the impact of the solutions found in the previous step. We determine whether the proposed solutions indeed solve the inter-organizational alignment issues within the process perspective (i.e., analyze solutions within perspectives). In addition, we determine how the solutions affect the other perspectives taken on the constellation at hand (i.e., analyze solutions between perspectives).

Alignment within perspectives. First, we analyze the impact of the proposed solutions (implement a common language and create a single point of information) on inter-organizational alignment within the *process perspective*.

In collaboration with the stakeholders, we conclude that the proposed solutions indeed solve the originally identified inter-organizational alignment problems. The solutions lead to a redesign of the process interactions in which (1) all the actors have the same terminology and valuation for the states of the airplanes and (2) all the actors share and receive relevant information timely.

Alignment between perspectives. We need to determine whether the perspectives considered in the Dutch aviation case are still aligned. In other words, do the various perspectives still represent the same networked value constellation at hand? As argued, in the context of e^3 *alignment*, the conceptual models represent "the same constellation" if the actors and interactions considered in a model can be related to actors and interactions in the other models. If actors and interactions in a model cannot be related to actors and interactions in the other models, then there should be a clear explanation for this. To this end, we analyze alignment between the process and IS perspective, and between the process and value perspective.

Due to space limitation, we do however not continue with the Dutch aviation case, but show examples from the Mobzilli case in the next section to illustrate inter-organizational alignment between perspectives. For more information on the Dutch Aviation case see [33].

7.2 Mobzilli: all the wrong business forces

In the following paragraph, we discuss aligning the strategic interactions of Mobzilli and their networked value constellation.

Step 1: Problem elicitation. Together with Mobzilli, we create an e^3 *forces* model (see Fig. 7) and apply the buyer, supplier, and competitor metrics described in Sect. 5. After a few iterations, we find scores we all agree upon. According to the supplier metric, the score for the supplier market Satellite Positioning is 90, mainly due to an imbalance in the market (e.g., the actor GPS dominates the market). This indicates a strong influence on the value object "position coordinates" offered to Mobzilli [34]. The value object is however free; therefore, the strong influence is on the configuration of the value object (e.g., accuracy) and not on the price.

Since each customer needs to have a mobile phone with GPS—which is a small group in the Netherlands—the buyer market customers have the high score of 79. Furthermore, because the type of advertisement channel offered by Mobzilli is not important for Merchants, the score of Merchants is also high (87). Finally, because the service is relative new, there is not (yet) much competition. Therefore, the strength of the competition is considered low. The e^3 *forces* model, including the strength of the business forces, is presented in Fig. 7.

Overall, Mobzilli has one supplier with a strong influence on the configuration of the service offered (e.g., accuracy of the "position coordinates"). In addition, Mobzilli has two strong business forces on the buyer side: Merchants and Customers. Both can influence the configuration of the service offered by Mobzilli. The influence of the aforementioned business forces does not match Mobzilli's business strategy "differentiation," since such a strategy best allows for influence on the price of the product/service, not the configuration of the product/service [20, 34].

This analysis provided the rationale needed by Mobzilli's stakeholders. They now understand why their initial design, with GPS technology, results in strategic interactions, which do not support their business strategy. So, on a strategic level, Mobzilli is not aligned with the organizations operating in its environment. These insights motivated Mobzilli to make some changes.
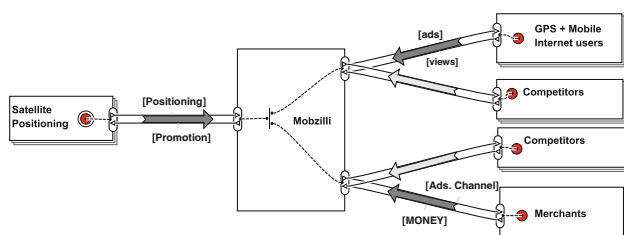

Fig. 7 e^3 *forces* model

Summary. Conditions for inter-organizational alignment from a strategic perspective:
–The influence of the business forces in the environment of the actor under investigation does not conflict with the actor's chosen business strategy.

Step 2: Design solutions. In the previous step, we found that a number of business forces have a strong influence on Mobzilli. To this end, the stakeholders of Mobzilli are inclined to redesign their strategic environment.

To deal with the strong supplier Satellite Positioning, the stakeholders chose to switch to triangulation positioning software. Unlike GPS, this software works via triangulation of signal strengths of GSM antenna's, making it an entirely different technical solution. Because more organizations are active in this market, the stakeholders hope that the influence of this market will be less in comparison with Satellite Positioning market. So, the supplier market Satellite Positioning is replaced by the supplier market Positioning Software. A side-effect of switching to triangulation software is that external software developers are needed to integrate the software into the other systems. Therefore, another market is added: "Software Developers."

To deal with the strong buyer market customers, the choice to use GSM triangulation technology is also beneficial. Customers only need to have mobile internet to use the technology. So the customer market becomes significantly larger. To deal with the other strong buyer market (Merchants), the stakeholder choose to target a second buyer market: "Cultural Organizations" (e.g., museums). As a result, Mobzilli's dependency on Merchants reduces, thereby reducing the Merchant's influence on Mobzilli. Furthermore, Cultural Organizations have less alternatives to target (foreign) customers; therefore, their influence on Mobzilli is predicted to be lower on Mobzilli than the influence of Merchants. The new model is shown in Fig. 8.

Step 3a: Analyze solutions: Alignment within perspectives. The strengths of the business forces are determined with the aid of the metrics described in Sect. 5. The result is already shown in the e^3 *forces* model presented in Fig. 8.

According to the suppliers metric, the score for Software Developers is 60; this is considered medium and is such because of the large number of actors present in this market. The score for Positioning Software is 80, indicating a strong force, although less than the original score of Satellite Positioning. Furthermore, the influence is again on the configuration and not on the price of the value object
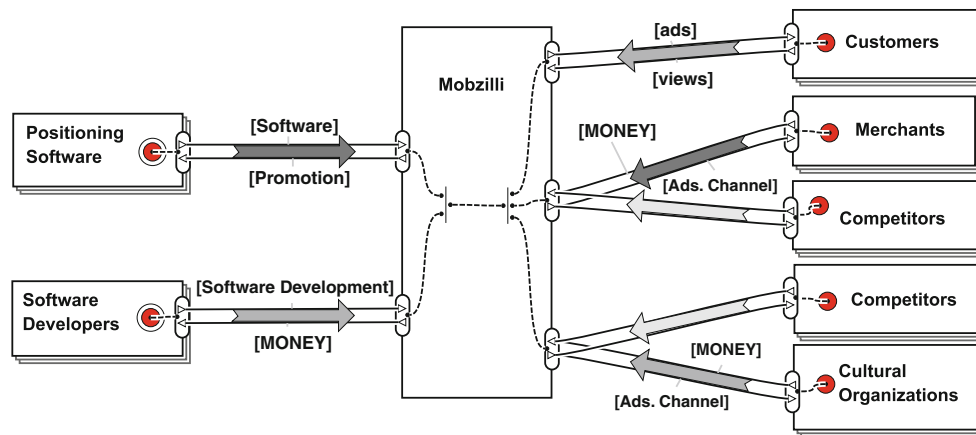
Fig. 8 e^3 *forces* model: first re-design

provided (the software is still free). Using the metric for buyer markets resulted in a score of 69 for customers; the score decreased due to the larger population of customers with a mobile phone than customers with a mobile phone with GPS technology. The new score for Merchants is 78, barely being high. By adding the market Cultural Organizations, more trading areas for Mobzilli are available. As a result, the strength of Merchants is decreased [34]. For Cultural Organizations, the scores is 65. The strength of Cultural Organizations is less than that of Merchants because less alternatives are at hand for this buyer market.

In the current design of Mobzilli's strategic environment, only one strong business force remains. So, the proposed redesign of Mobzilli's strategic environment provides a strategic position, which enables the execution of the chosen business strategy (see Fig. 8). In the presented design, the business forces have less influence on the configuration of the service offered by Mobzilli and thereby enables the business strategy "differentiation" [34]. This notion was supported by Mobzilli.

By carefully choosing suppliers and buyers, a strategic environment is found, which has a minimal possible influence on the configuration of Mobzill's service. In comparison with the first strategic position, the strength of suppliers has decreased with 13% and the strength of buyers with 17%. Subsequently, we can state—and are supported on this by the stakeholders—that there are currently no inter-organizational alignment issues in the strategic perspective.

Step 3b: Analyze solutions: Alignment between perspectives. The solutions proposed will have their effect on alignment between the strategic and value respectively IS perspective. For instance, in the new e^3 *forces* model, actors are present, which are not present in the e^3 *value* model. Subsequently, the modifications proposed to the strategic perspective have led to incorrect alignment between the strategic and value perspectives.

As discussed, we do not relate the strategic perspective directly to the IS perspective, but do so via the value perspective. Since at this point the value and IS perspectives are aligned, but the value and strategic perspectives are not, we reason that the IS and strategic perspective are also not aligned. In addition, to demonstrate the versatility of e^3 *alignment*, we go a bit faster in this iteration. We are going to analyze alignment between the strategic and value perspectives *and* alignment between the strategic and IS perspective (via the value perspective) in a single iteration.

Step 1: Elicit problems. If we compare the e^3 *forces* model in Fig. 8 with the e^3 *value* model in Fig. 9, then we see a number of differences: (1) The actor Software Developer is not present nor are the actors Positioning Software and Cultural Organizations; (2) The value transactions between these three actors and Mobzilli are not modeled; (3) In the e^3 *value* model, the actor GPS is present, yet this actor is no longer present in the e^3 *forces* model.

The solution is a redesign of the original e^3 *value* model. The new e^3 *value* model is presented in Fig. 10. As can be seen, there are three new entities: the actors Software Developers and Positioning Software, and the market segment Cultural Organizations, which acquires the advertisement channel from Mobzilli.

Due to the conceptual gap between both perspectives, we cannot directly determine alignment problems between the strategic perspective and IS perspective. So, we must explore alignment between the strategic and IS perspective via the value perspective.

However, at this point, it is already very clear that the strategic and IS perspective are not aligned: the IS architecture (Fig. 11) is made with the assumption that GPS technology is used, while the e^3 *forces* model (Fig. 8) assumes triangulation technology. As a result, actors and
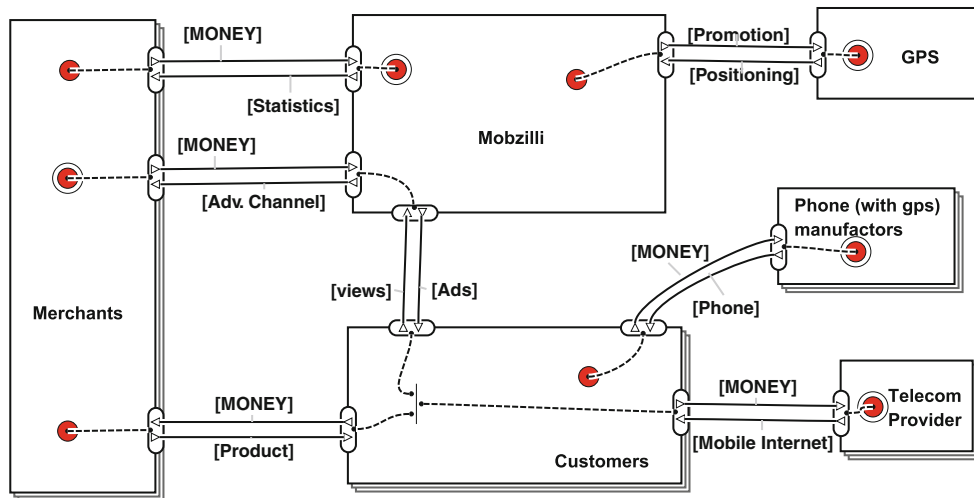
Fig. 9 e^3 *value* model: first design
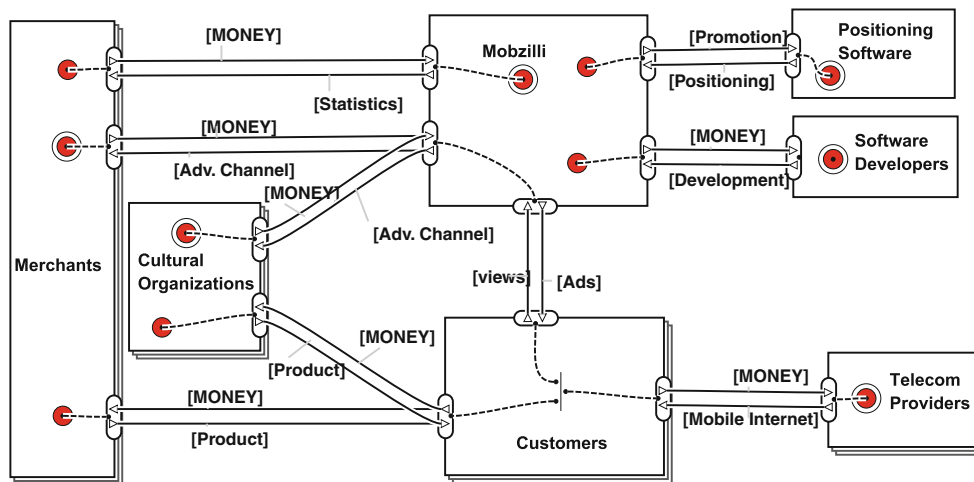

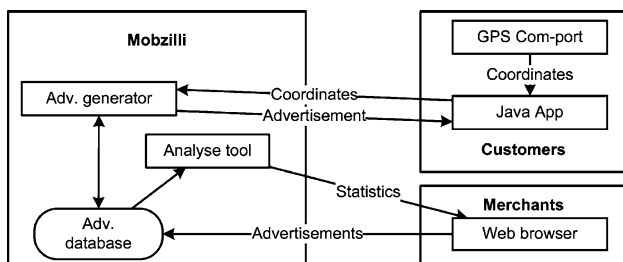**Fig. 10** e^3 *value* model: re-design

Fig. 11 IS architecture: first design

interactions are present in the e^3 *forces* model, which are not present in the IS architecture.

Note that in this case we were able to determine that the strategic and IS perspective are not aligned without the aid of the value perspective. However, in many other cases, it might not be so clear; therefore, we normally determine

alignment between the strategic and IS perspective via the value perspective.

Step 2: Design solutions. We need to redesign the IS architecture to restore alignment with the e^3 *forces* model. However, we do not know the direct relationship between IS architectures and e^3 *forces* models. We do know the relationship between e^3 *forces* models and e^3 *value* models, and between e^3 *value* models and IS architectures. So to align the IS architecture and e^3 *forces* model, we first need to make an e^3 *value* model based on the e^3 *forces* model, which is shown in Fig. 10.

Figure 12 shows the new IS architecture, which is based on the new e^3 *value* model. As we can see, GPS is no longer used, which is a direct result from the strategic choice of Mobzilli to provide their location-based advertisement service to a larger customer market (see previous exploration cycle). Instead the GSM module is called to
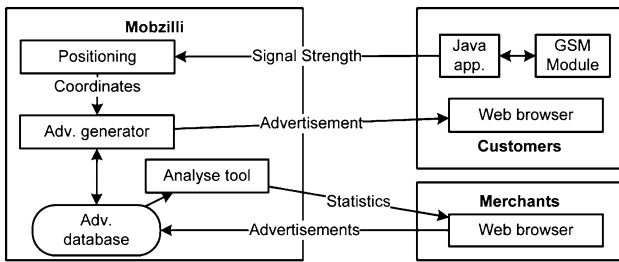
Fig. 12 IS architecture: re-design

provide the signal strengths of different GSM antenna, which are used to determine the location of the customer. The choice for triangulation requires an extra component to be added to Mobzilli's IS, "positioning." Note that only one possible solution is modeled, but more exist. For instance, the computation could also occur within the Java applet present on the mobile phone. Basically, it is a question of centralizing the computation to Mobzilli's server (greater server load) or decentralizing the computation (modifications more difficult).

For the Mobzilli case, the e^3 *alignment* exercise entailed many more steps and iterations. At this point, we however stop with the e^3 *alignment* exercise for Mobzilli. To see more on e^3 *alignment* and the Mobzilli case see [31].

7.3 Spanish electricity: integrating DERs

In this section, we illustrate e^3 *alignment* with the aid of the Spanish electricity case. In this phase of the e^3 *alignment*

process, the actors of the Spanish electricity already have redesigned the value perspective such that DERs can be economically feasible integrated into the current Spanish electricity market. This solution is presented in Fig. 13.

Step 1: Elicit problems. We compare the e^3 *value* model in Fig. 13 and the IS architecture in Fig. 14. We find that if an actor wishes to sell electricity produced by a CHP, the actor has to inform the Supplier how much electricity is *produced*. Currently, there is no such source of information within the IS architecture. Only information regarding the amount of electricity *consumed* is modeled in the IS architecture (see Fig. 14).

In addition, in the e^3 *value* model, an actor is present, which is not found in the IS architecture: CNE. For CNE to perform its task (provide subsidy), CNE's information system needs to be connected to the other information systems in the electricity power system. Currently, this is not the case, since both CNE and its interaction with Consumers with CHP are not present in the IS architecture.

Step 2: Design solutions. The first problem is the lack of an information source for the amount of electricity produced by a CHP. To this end, the stakeholders propose to include a two-meter system in the IS architecture (see Fig. 15). The two-meter system measures (1) the total amount of electricity *consumed* by an organization and (2) the total amount of electricity *produced* by the CHP of that same organization. The
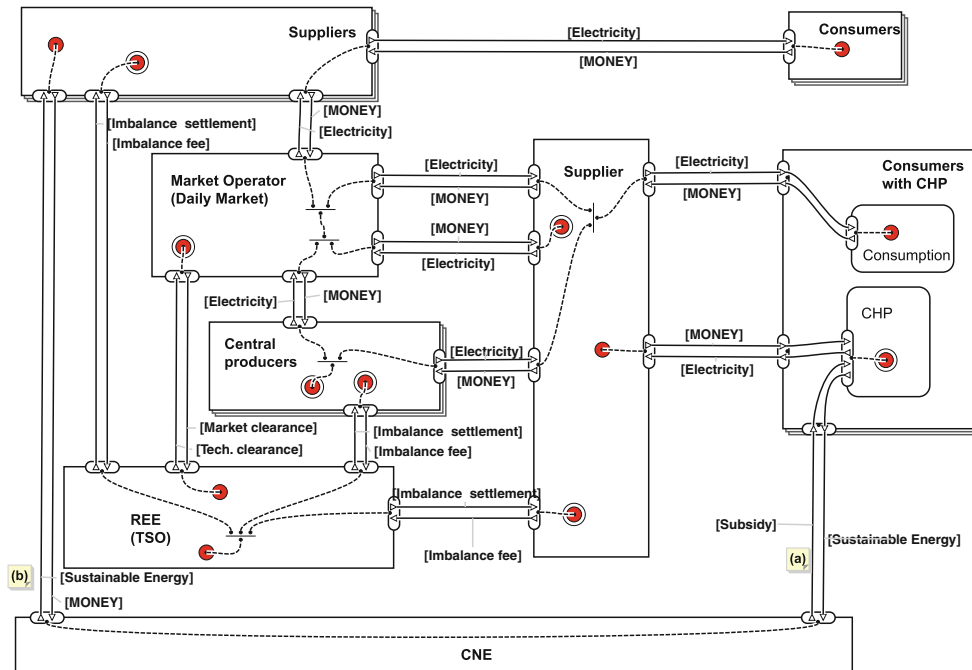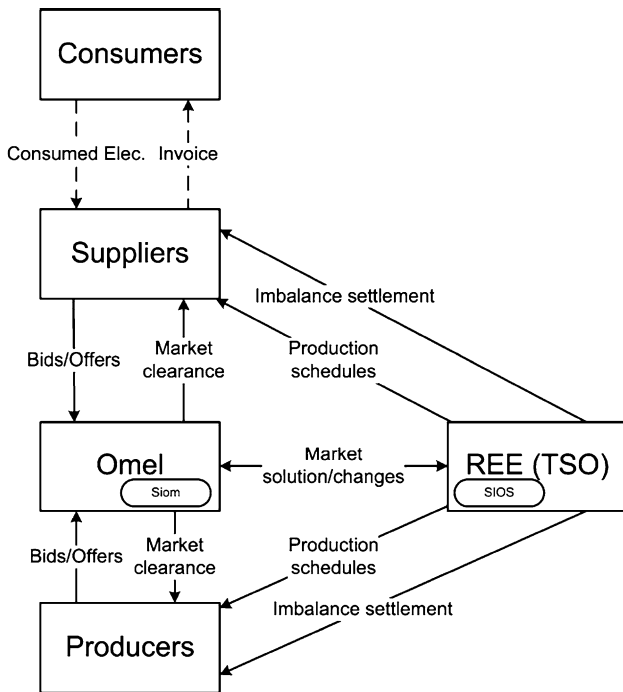

Fig. 13 e^3 *value* model
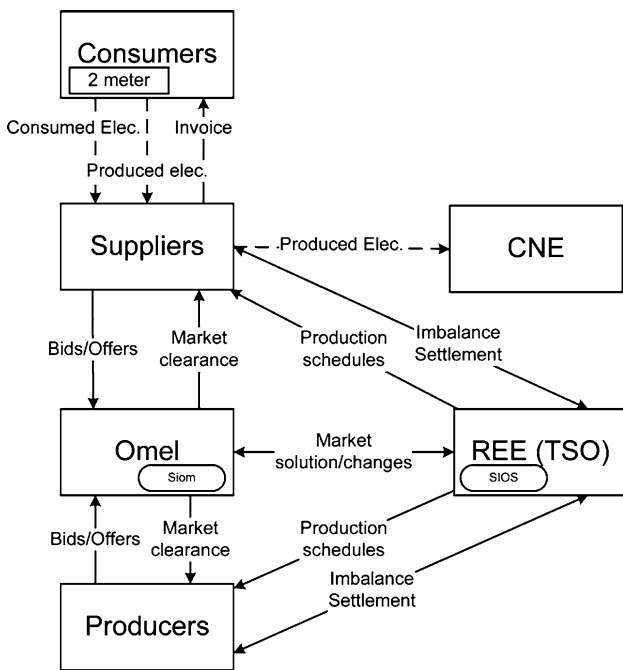
Fig. 14 IS architecture current situation

Fig. 15 IS architecture: CNE included

source is located within the Consumers with CHP and the information is transferred to the Supplier. Currently, this information is transferred manually, meaning an actual person has to read the meters. In the future, this

issue might be solved, but at this point the issue is not of interest.

To solve the second alignment problem (the actor CNE cannot exchange information with other organizations), the IS perspective is modified by including CNE and its information systems, as well as the interactions between CNE and the other actors (see Fig. 15). In the new architecture, CNE acquires information from the Consumers with CHP on the amount of electricity produced by the CHP.

Summary. From a conceptual modeling point of view, the value and IS perspectives are aligned if:
–The actors in the IS architecture are a subset of the actors in the corresponding e^3 *value* model.
–The information exchanges can be linked to a value transfer in the corresponding e^3 *value* model.

Step 3: Analyze alignment solutions. If we compare the value and IS perspectives, we find that the perspectives represent the same constellation at hand. This means that there is alignment between the perspectives. However, additional alignment issues still exist in the value perspective (e.g., imbalance).

As with the Mobilli and Dutch aviation case, we stop prematurely due to space limitations. For more information on e^3 *alignment* and the Spanish electricity case see [32].

8 Lessons learned

Four perspectives are sufficient. The e^3 *alignment* framework takes four perspectives on the networked value constellation at hand. This however does not mean that other perspectives cannot, or should not, be considered. Laws and people's psyche regulate the behavior of individuals and organizations, indicating that many aspects of an organization are beyond business and ICT, but still influence the success of the organization [7].

Our findings however indicate that stakeholders usually take interest in no more than *three* out of the four perspectives. To illustrate: Mobzilli's stakeholders were mainly concerned with a proper (strategic) business model and IS architecture. The Dutch aviation's stakeholders were mainly concerned with business processes, value creation, and IS architectures. The Spanish electricity's

stakeholders were mainly concerned with a proper business model and IS architecture. As we have illustrated in this article, it is still possible to explore inter-organizational business-ICT alignment without considering all four perspectives. So more perspectives are not required for what we intend to achieve with the e^3 *alignment* framework: *exploring inter-organizational business-ICT alignment*.

Simultaneous development of models to save time. The order in which alignment problems are dealt with is not important, as long as each alignment issue is eventually deal with. Two examples from our case studies support this notion. First, in the Mobzilli case, we dealt with two alignment problems simultaneously. Would we have dealt with them one by one, the same final configuration would have been reached (which we validated). Also, at one point, we ignored one alignment issue to focus another issue, only to resolve the original at a later stage. A quick analysis with Mobzilli's stakeholders revealed that if we had tackled this alignment problem first, we still would have found the same final configuration. We have had similar experiences in both the Dutch aviation case end Spanish electricity case.

The value perspective is the central factor. As argued, we only intend to create alignment between the strategic and value perspectives, the value and process perspectives, and the value and IS perspectives. So, we do not directly align the strategic perspective and process respectively IS perspective. Instead, we align the strategic perspective and process respectively IS perspective via the value perspective. We do so because of the conceptual gap between the strategic perspective and process respectively IS perspective.

We used the Mobzilli case to compare (a) directly aligning the strategic perspective and the IS perspective to (b) aligning the IS perspective and strategic perspective *via* the value perspective (see [30]). Stakeholder feedback supports the idea that, although it is possible to directly align the strategic and IS perspective, it is easier to align the strategic and IS perspective via the value perspective. Such was claimed by the stakeholders because they could easily grasp how a technology leads to value creation (on the short-term) and then make the step from value creation to long-term strategic implications. A similar reasoning is also applied for the exclusion of alignment between the strategic and process perspective.

Separation of concerns to focus on the key issues at hand. e^3 *alignment* provided practitioners a unique insight into inter-organizational business-ICT alignment. e^3 *alignment*'s theoretical framework is clear and easily understood by stakeholders from different backgrounds. Stakeholders state that e^3 *alignment* helps them consider aspects previously not considered. Such is possible because of two reasons: (1) Each perspective has clear boundaries

so that alignment issues are isolated to a single perspective, and solutions can be designed within the confines of that perspective, (2) the perspectives share a common denominator–interaction–which makes it clear how the various perspectives are related.

Developing proper conceptual models. Understanding the conceptual framework behind e^3 *alignment*, and understanding where alignment issues, might occur was one thing, creating the models was a different challenge. Actually creating conceptual models and aligning the models (e.g., the "tools" e^3 *alignment* provides) are proved to be a challenge for many stakeholders. We, the researchers, have a lot of experience with developing and utilizing conceptual modeling technique. Subsequently, the "tools" of e^3 *alignment* were clear to us. Practitioners commonly do not have such experience with conceptual modeling. For them, a conceptual model was no more than a number of boxes and lines without true meaning.

Yet, the potential of conceptual models as the tools for creating business-ICT alignment was clear to all stakeholders in all the three case studies. Also, we listened with great interest to their comments regarding the conceptual modeling techniques. Considering the stakeholders comments, we evaluated our conceptual modeling techniques and made adjustments to better meet practitioners requirements (e.g., e^3 *value* and e^3 *forces* have evolved significantly in the last years).

9 Discussion

Does e^3 *alignment* provide a valuable contribution to the research field of business-ICT alignment and to practitioners in real life? We believe the answer to be positive.

As discussed in Sect. 3, the focus of business-ICT alignment has shifted from alignment within a single organization (e.g., [18]) to alignment between organizations (e.g., [11, 19]). Our case studies demonstrate the relevance of inter-organizational business-ICT alignment, since all stakeholders were faced with multiple inter-organizational business-ICT alignment issues.

Also, remember that one key challenge of business-ICT alignment research, as pointed out by Chan and Reich (see [7]), is to provide practitioners with the tools needed to create alignment. e^3 *alignment* provides the tools in the form of conceptual modeling techniques. Although conceptual modeling was new and often unclear to the stakeholders, the stakeholders showed great interest in the models and wanted to learn more about developing and utilizing conceptual models. TOGAF [43] and Heumer et al. [19] also provide tools to practitioners to analyze and create alignment. Yet one important difference is that e^3 *alignment* provides light-weight modeling techniques,

making it easier for stakeholders to learn the modeling techniques. Furthermore, we believe e^3 *alignment* should be used during the exploration phase of an alignment exercise. For this stage, the techniques provided by TO-GAF and Heumer et al. are complex.

In addition, we see providing clear (albeit a bit theoretical) steps to take during a business-ICT alignment exercise as a valid contribution to the field of business-ICT alignment research. Especially since the "process of alignment" is neglected by most other alignment frameworks/approached (see [7]). Practitioners also pointed out that it helps to know "what to do when." We must however note that business environments are very dynamic and time is scarce. There is simply not always time or resources to properly follow all the steps described. Still, we believe this to be a universal problem to business-ICT alignment, not a result of the e^3 *alignment* approach.

10 Conclusions and future work

Future work. Currently, the activities in e^3 *alignment* are performed by humans. However, to scale up to larger problems, the human cycles could be complemented (at least partly) by automatic techniques that can reason about patterns across many different perspectives and cases. Therefore, the conceptual models must be fully computational.

From a model-driven engineering corner, OMG[1] already pushes forward standards for *business modeling and alignment* (incl. UML, business process model and notation (BPMN) and business motivation model (BMM)) that can be adopted to model the different perspectives in e^3 *alignment*. The advantage is that all these meta-models share a common umbrella framework called Meta-Object Facility.

Key prerequisite is *business semantics management* (based on [10]), in other words: the reconciliation of the semantics of business vocabularies and business rules (SBVR) that are used to model these different perspectives. SBVR is a standard that is based on fact-oriented modeling and is also part of OMG'S MOF framework. Moreover, particularly interesting in an inter-organizational setting is that SBVR also allows modeling the semantics of the community and its different stakeholders itself. This enables more transparent governance of the differences and commonalities in stakeholder perspectives on the vocabularies and rules. For a comprehensive description to deal with the methodological, technological, cultural, and organizational aspects of collaborative business semantics

management using SBVR, we refer to [8] (with a case in competency-centric HRM) and [9] (with a case in public administration).

Conclusions. We have introduced e^3 *alignment* as an approach to create business-ICT alignment for organizations operating in networked value constellations by (1) focusing on the *interaction* between these organizations, (2) considering interaction from *four* different perspectives, and (3) utilizing conceptual *modeling techniques* to analyze and create business-ICT alignment. Since e^3 *alignment* takes multiple perspectives on interaction, e^3 *alignment* creates alignment between organizations not only *within* each single perspective, but also *between* the perspectives. To actually create alignment, e^3 *alignment* iteratively takes three specific steps: (1) identification of alignment issues, (2) solution design, and (3) impact analysis.

The case study performed justify the focus of our research and subsequently e^3 *alignment*. In each of the case studies, the stakeholders were faced with inter-organizational business-ICT alignment issues in real life. The case studies also showed that the e^3 *alignment* approach is valuable for practitioners. By analyzing the interaction between the organizations from four perspectives, we discovered multiple alignment issues (and designed solutions also). We were able to do so by using the conceptual modeling techniques and following a clear process of alignment.

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[1] see
http://www.omg.org/technology/documents/br_pm_-spec_catalog.htm

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