Consonance Between Economic and IT Services: Finding the Balance Between Conflicting Requirements

Maryam Razavian(✉) and Jaap Gordijn

VU University Amsterdam, Amsterdam, The Netherlands
{m.razavian,j.gordijn}@vu.nl

Abstract. [**Context and motivation**] Service Orientation has been heralded as the solution for seamless alignment of the business and IT. [**Question/problem**] Alignment, however, remains far from being resolved. [**Principal ideas/results**] While alignment research typically concentrates on *mapping* the counterpart elements, this paper provides a case for what we coin *consonance*—the mutual adjustment of conflicting requirements between business and IT perspectives. In previous work, we have identified inherent discrepancies between the requirements of the business- and IT perspectives. [**Contribution**] In this paper, to better understand such discrepancies and the kind of support needed for their consonance, we have carried out a real-world example in the music industry. Moreover, we study consonance in a networked setting; both in terms of a business network of enterprises, and in terms of a cross-organizational IT network. The use of the consonance approach in this example reveals important lessons learned.

1 Introduction

Service orientation has transformed many traditional, internally focused, information systems into externally visible *e-services*—commercial services provided via information technology (IT) offering customer value in return for payment or something else of value. Consider for instance the music industry, our real-world example domain. When radio stations broadcast music, they have to pay to Intellectual Property Rights (IPR) societies, who in turn distribute money over IPR owners such as artists, sing & song writers, and producers. Clearing rights and repartitioning the collected money over the IPR owners are *commercial services*, enabled by IT, which are of value to the rights owners and the radio station. Usually, a music track entails a number of IPR owners which can live, to complicate things, in different countries. Consequently, more than one IPR society is involved if a radio station broadcasts a track, as societies are often organized per type of IPR owner, country and value adding activity (e.g., clearing or repartitioning). This case, thus, forms a *network* of enterprises and individuals (radio stations, IPRs, IPR owners), using each other's services. This network is both a *business* and *IT* network; a business network because the

S.A. Fricker and K. Schneider (Eds.): REFSQ 2015, LNCS 9013, pp. 148–163, 2015.
DOI: 10.1007/978-3-319-16101-3_10

parties involved exchange things of economic value with each other, and an IT network as IPR management is largely supported by cross-organizational IT.

This example illustrates that in order to design, manage and maintain requirements for e-services, multiple perspectives should be taken into account, including the strategic, economic, process, and IT perspective [1]. In this work we scope down to two perspectives: namely the *economic perspective* and *IT perspective*. These two perspectives view e-services very differently, pursue different goals, and focus on different requirements. For example, the economic perspective views the IPR e-service as a number of commercial services that are of economic value for IPR owners, therefore satisfy the requirement of a profitable company. The IT perspective, on the other hand, focuses on exposing the functionality and architecture of cross-organizational IPR information systems, and ensures that they are reusable and flexible. Although the economic and IT perspectives view e-services differently, they are also related. For instance, in the IPR case, payment by the radio station for the usage of a music track (economic perspective) should be properly supported by administration of granting the right and handling of payments (IT perspective).

In general, developing economic e-services requires a dialogue between the economic/commercial considerations and information technology choices. In other words, in the context of e-service design, *Requirements Engineering* as a discipline should not only cover information system requirements, but also economic considerations, and their interrelationships such as economic sustainability of the e-service to be developed.

Considering economic and IT requirements of e-services is vastly complex. In earlier work [2], we found that this complexity roots in the conflicting and even contradicting requirements of the two economic and IT perspectives. Intuitively, these conflicts necessitate trade-offs, which are in their own right new problems, potentially more complex than the originals. Although conflicting requirements are inherent in the service alignment endeavors, none of the existing approaches capture them explicitly. Because of the focus on requirements discrepancies, we refer to the term *consonance* to characterize our approach.

In this paper, we propose a *tractable*, *easily understandable*, and *model-based* approach to deal with such requirement conflicts—by treating them as *first class* citizens of the requirements engineering process for e-services. Tractability refers to the idea that our approach should be carried out rather easily, and in a short time frame, as most innovative e-service development projects due the competitive nature require fast execution. Understandability is an important concern because our approach has to deal both with commercial, business and IT-oriented stakeholders. Finally, our approach is model-based to be usable in an information system development follow-up project.

This approach has emerged from our experience in a real-world example with an IPR society, where it proved effective in understanding the *current state* of consonance. On the long term, our research goal is to provide an assessment instrument that evaluates whether a change in the economic perspective (e.g. a change in the value proposition) can still be supported by service oriented information technology, so considering the *future state* of consonance.

The contribution of this paper is threefold: (i) we provide a consonance approach that brings a series of discrepancies between economic-and IT perspectives into focus. (ii) we approach the consonance of business and IT from the customer value proposition point of view, as well as the economic value network. This is in contrast with many approaches on business/IT alignment (e.g. [3]) that usually start with an understanding of the business strategy or business goals (e.g. [4]) or even business processes. (iii) we distinguish ourselves by taking a *network* perspective on business and IT; as industrial practice often relies on networks of enterprises offering jointly a bundled service, rather than just a single enterprise offering a simple service.

2 Context and Groundwork

2.1 Multiple Perspectives on Services: A Balancing Act

Service-oriented requirements engineering can be perceived as developing at least the economic and IT perspectives on a *single artifact*, namely the service at hand. These two perspectives have different foci: the economic perspective concentrates on *commercial services for whose provision someone has to pay*, while the IT perspective considers the *IT elements that* realize *the commercial services*. Following this observation, a service in the economic perspective, has a (number of) IT service counterpart(s) in the IT perspective; aligning the two perspectives 'only' requires to link the counterpart services between the two perspectives.

However, in earlier work [2] we found that this perception constitutes the major reason behind why service alignment is so difficult. In particular, we argue that the economic- and IT perspectives are *not* two faces of the same concept; instead they are *two very different concepts*, pursuing different and even conflicting requirements, and are comprised of inherently different elements. For instance, the economic perspective refers to *commercial* services, whereas the IT perspective is about *web* services. Although web services may put commercial services into operatfion, from an ontological point of view they are very different citizens. Such fundamental conflicts and differences between the two perspectives makes the alignment a complex, wicked problem [5].

In the same earlier work [2] we proposed inherent *discrepancies* between the two perspectives highlighting their conflicting requirements. Addressing these conflicting requirements means making trade-offs. One example of such a trade-off is profitability/sustainability versus openness. For our example on IPR, on the one hand, a IPR society is supposed to be at least economically sustainable, thus operating at as low costs as possible, such that the maximum amount of collected money can be paid to the appropriate IPR owners. On the other hand, however, IPR societies should be open in terms of operating with other actors (both business- and IT-wise). Such openness comes with a price which is a pressure on sustainability, and at the end of the day, decreases the amount of money to be paid to IPR owners. In general, for the earlier mentioned discrepancies, we claim that the economic and IT-perspectives should explicitly address the conflicting requirements in order to a find a balance. We refer to such a desired state

as *consonance*—where the very different requirements are in harmony—rather than *alignment* (i.e., only linking the counterpart elements).

2.2 Our Consonance Approach

In this paper we capture the As-Is situation of the economic- and IT perspective of the IPR example and analyze the state of consonance between the two perspectives. We model the economic perspective using e^3value [6] and explain this perspective along the line of the IPR example in Section 3.1. We model the IT perspective using *SoaML* [7] and explain it in Section 3.2. We chose these notations because they (i) capture the relevant perspective adequately, (ii) are expected to satisfy our requirements with respect to tractability and understandability, and (iii) are model-based. However our consonance approach is notation agnostic; any modeling notation that fulfills the above goals and motivate conceptual overlap between the perspectives can be used.

To capture the state of consonance between the economic and IT perspectives, we need an effective common ground that closes the gap between the elements of the two perspectives. In [2] we provide such a common ground in the form of *core elements* of Service Orientation, including: *actor, service, interaction, and contract.* What these core elements imply, however, is very different in the two perspectives, rooting in the inherently different requirements of the two perspectives. Table 1 provides an overview of the conceptual discrepancies of the core elements in the two perspectives as well as their rationale.

Moreover, to make consonance between two perspectives, we must perform trade-offs among the various requirements classified as belonging to each of the two perspectives. The requirements of the two perspectives may influence each other in positive or negative manner. In our approach we directly focus on these influences and their associated trade-offs. In short, our consonance approach embraces the following steps:

- **Step 1.** The starting point is to model the the As-Is and To-Be states. For the economic perspective, we can construct a basic e^3value model for the e-service at hand that at least contain the the core elements: the most important "actors" (e.g., the e-service provider and its customers and suppliers); the most important "commercial services"; the "contracts" and the "interactions" between actors. For the IT perspective, we should model the service network architecture with the types of "actors" that collaborate to provide IT services, provided and consumed "services" expressed as "contracts", as well as the "interactions" between actors involved in a contract should be modeled too.
- **Step 2.** For each of the core elements, we evaluate to what extent the corresponding requirements of the two perspectives are fulfilled (see Table 1). For instance, focusing on "actors"—looking from the lenses of the economic perspective we check if they are economically sustainable (economic perspective)– looking from the lenses of IT perspective, we check if the IT enables the actors to come and go on-the-fly. For our example on IPR, we check if the IPR society

Table 1. Overview of the different requirements of the core elements between the two perspectives [2]

	Economic Perspective	IT Perspective
Actor	**Actors instances who are profit-and-loss responsible legal entities**. *Rationale: the economic perspective focuses on how each actor would make profit or increases its utility.*	**Service provider or consumer that are open**. *Rationale: This perspective cares for flexibility and openness (actors should be able to come and go on-the-fly).*
Service	**Commercial services that for their provision an actor has to give something of value in return** *Rationale: economic perspective deliberately focuses only on services that have direct economic value.*	**Repeatable and reusable capabilities that can be invoked by various consumers**. *Rationale: IT perspective cares for reusability of services enabling their economies of scale.*
Contract	**Caring about how actors assign economic value to the obtained services**. *Rationale: economic perspective cares about what an actor offers and what an actor requests in return.*	**Agreements about how to technically interact, such as protocols**. *Rationale: IT perspective cares about information needed for communication*
Interaction	**Economic value transfers such as service outcome or transferring money.** *Rationale: Economic perspective focuses on interactions that represent reciprocal value transfers—value transfers that represent a change in valuable rights, such as right to use a services or ownership.*	**Message exchanges between participants.** *Rationale: IT perspective cares for loosely coupled interactions to maximize independence of services as well as their providers and consumers.*

operates at lowest costs, such that the maximum amount of collected money can be paid to the appropriate IPR owners. From IT perspective, however, IPR societies should be open in terms of operating with other actors (IT-wise).

– **Step 3.** We analyze the trade-offs required for *simultaneously* fulfilling the requirements of the two perspectives. The essence of this step is to explore and scope the consonance areas of concern, *broadly*. Then, one core element is selected, we go *deep* in both the economic- and the IT perspectives, and find the desired, possibly future, requirements of economic- and IT perspectives, e.g., having economically sustainable actors (Economic Perspective) that are open (IT perspective), *simultaneously*. At this stage, we should assess if such ideal state is possible; and if not we should do trade-offs. For trade-off analysis, one can follow the existing approaches such as ATAM [8]. While assessing the state of consonance in depth, we can regularly switch to breadth-first and explore the context of consonance again, and vice versa.

3 Running Example: Clearing and Repartitioning Intellectual Property Rights on Music

Our real-world example is on an *Intellectual Property Rights (IPR)* e-service. This e-service involves a large international network consisting of *IPR societies* as well as *IPR owners* (e.g. artists, producers) and *IPR users* (e.g. radio station, restaurants). In general, many different IPRs exist; however in this paper we focus on the *right to make content public*. Commercial entities (e.g. radio stations) have to pay IPR owners (e.g. artists) a fee for using intellectual property

(e.g. a music track), if they make it public. The IPR society collects money from the IPR user (called *right clearance*) and pays money to the IPR owners (called *repartitioning*). *Clearance* and *repartitioning* are commercial services that are semi-automated. In the following, we explain the economic- and IT perspectives of the current state of IPR e-service, using the scenario of a restaurant playing background music.

The goal of our study was to get a close up reality of what is like when consonance is assessed from discrepancy and conflict point of view. We focused on the *Clearance* and *Repartitioning* commercial services of the IPR society. The *stakeholders*, who were experts in economic- or IT perspective, were the Chief IT and Chief Financial Officer of the IPR society. We organized a number of workshops where, together with stakeholders, we applied our consonance approach (see Section 2.2). We audio recorded and later analyzed the workshops.

3.1 Economic Perspective

Fig. 1 shows an e^3value model representing that a restaurant plays background music and has to clear intellectual property rights for that. The model shows the value transfers for a time period of one year.

As there are many restaurants, the Restaurant actor is modeled as a market segment. Usually, restaurants do not play background music themselves but obtain a stream of background music from a Background music provider. Because there are a number of background music providers to choose from, the provider is modeled as a market segment too.

The restaurant has to exchange objects of economic value with three parties: (1) the already mentioned Background music provider, and (2) two IPR societies (RS1 and RS2). Because the restaurant plays the music in public, the restaurant has to pay the relevant IPR societies for the right to make public (RTMP). The fee depends on the number of square meters of the restaurant.

In general, IPR societies differ in the right(s) they clear and for whom they do so. IPR societies can perform two tasks: clearing, and repartitioning. Clearing is about granting the right to the IPR user and getting paid for that. Repartitioning is about paying the collected fees to the IPR owners. Sometimes IPR societies can do both tasks, but they may also concentrate on one of these tasks.

In this study, we assume that there are two IPR societies involved to clear the rights to make public. For brevity, we detail only such a society, namely RS1.

Considering the Background music provider, we see that the background music provider also has to clear rights with the relevant IPR societies. This is because the background music provider also makes the music public (namely to the restaurants) and consequently has to pay for that. Again, the background music provider is charged, but now based on market research in combination with the playlist of the broadcasters and the background music suppliers. For playlist reporting, background music providers are supposed to behave as Radio stations reporting their playlists; consequently playlist reporting by the background music providers are not shown explicitly in the e^3value model.

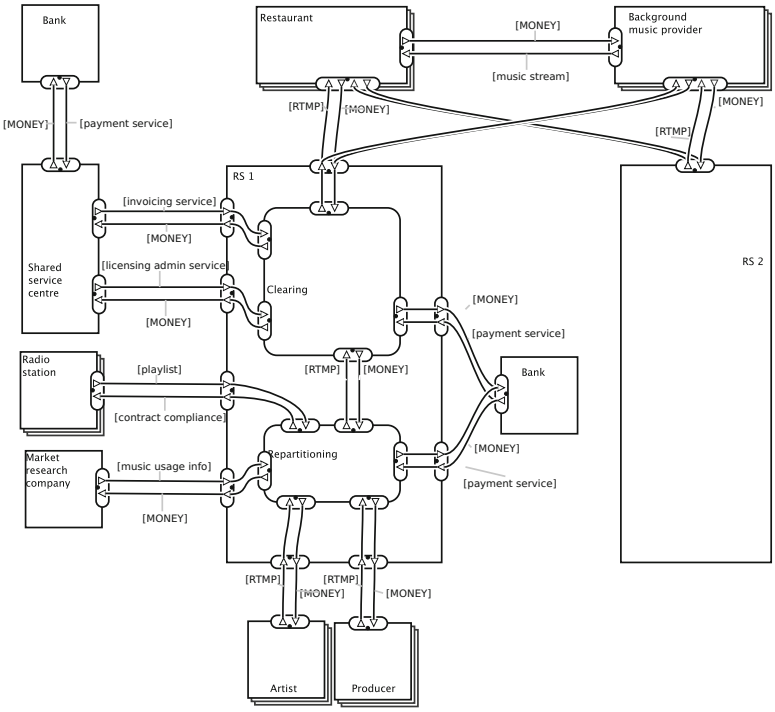


Fig. 1. As-Is value model for handling music rights - background music in restaurants

Considering RS1, we see that this society performs two value activities: (1) Clearing the right to make public, and (2) Repartitioning the right to make public.

The clearing activity obtains from each restaurant an amount of money *yearly*. The clearing activity obtains also money from the background music providers. Parts of performing the clearing activity are outsourced, in this case the licensing administration, and invoicing. Consequently, the results of these activities are modeled as separate value object services in the model, for which RS1 pays a fee. The shared service in turn uses a banking service to collect payments by the restaurants and background music providers. The repartitioning activity obtains the money pot build by the clearing activity, and divides the pot over the IPR owners. To do so, the IPR society obtains the playlists from a number of important radio stations. In order to obtain the playlists, the IPR societies offer legal contract compliance in return. Radio stations are obliged to give these playlists, as a result of their contracts with IPR societies. Additionally, market research is done to understand the tracks played by other IPR users than radio stations, so e.g. the restaurants. To this end, the IPR society hires a Market research company to perform the market research on music usage. The playlist and market research information is used to divide the money pot over the IPR owners. Finally, in order to do the actual payment, the IPR society uses a banking service, for which it pays a service fee.

3.2 IT Perspective

The IPR society operates its core activities, i.e., clearing and repartitioning, through a number of software systems, that are interconnected and are exposed to the outside world as services; and by consuming IT services provided by other actors. The interactions between the services are mainly message- and/or file-based.

With respect to the clearing service, Fig. 2.I shows that the restaurant uses an application, here called `:BMuser`, that invokes the streaming service (the service realizing the `:Streaming` contract in Fig. 2) of the `:BMProvider`. To pay the fee for broadcasting music to the IPR society both `:BMuser` application of the restaurant and the `:BMProvider` of background music provider invoke the `:Clearing` service. The bottom of Fig. 2.I shows that the IPR society carries out the clearance activity with two external parties: `:SharedSeviceCenter` and `:InvoicingProvider`. The IPR society has a software system called `:UserLicenseSys` that manages the licenses that music users (e.g., restaurants) obtain. In order to get the information about the new businesses the IPR society invokes the service enabling `:LicenseAdministration` of the `:SharedSeviceCenter`. For payments to be payed by music users, the clearance management system `:ClearanceMngSys` calls the `:Payment` service of the invoicing provider.

For the repartitioning service, the radio stations and the background music providers are obliged to provide playlist information to the IPR society. The IPR society provides the `:Playlistinformation` that music users can use to report the playlist information. To receive the playlist information gathered by the market research company the IPR society calls the `:MusicUsage` service. The IPR society (`:RightSociety` in Fig. 2) provides `:Repertoire Info Service` to the IPR owners in order to register intellectual work (e.g., a track in which they produced). That way IPR owners (e.g., record company) can invoke this service to manage repertoire information of their intellectual property.

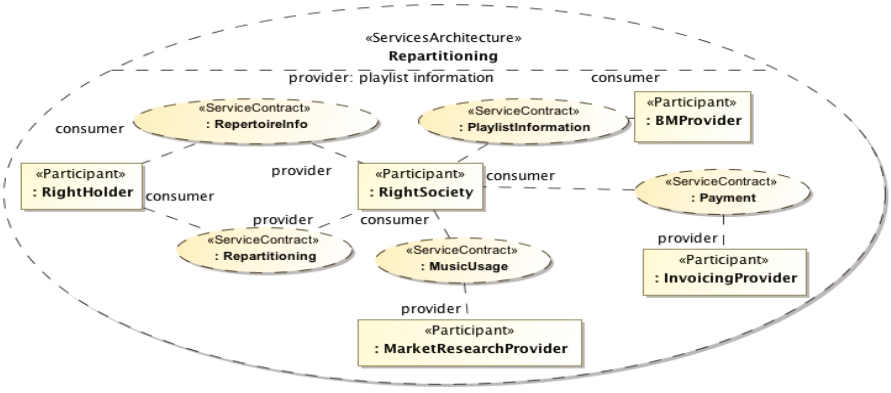
4 Consonance between the Perspectives

We see consonance as a general problem aiming at relating the two economic- and IT perspectives and addressing a set of general trade-offs that cross-cut the two perspectives. Previous section presented the result of *Step 1* of our consonance approach where we modeled the economic and IT perspective of the IPR e-service. In this section we relate these two perspectives. First, we zoom into the different requirements of the two perspectives and the extent to which they are met (*Step 2*). Next, we present the resulting trade-offs of fulfilling both perspectives' requirements, simultaneously (*Step 3*). Due to space limitations, we only report the more interesting trade-offs related to actors and services.

4.1 Actors That Are Economically Sustainable and Open

Economic sustainability of actors From the economic perspective, we assessed whether and how each actor is economically sustainable. In particular, we looked

I. Clearing Service Network Architecture



II. Repartitionig Service Network Architecture

Fig. 2. As-Is IT architecture for handling music rights - background music in restaurants

at two main aspects: (i) if/how the actors create some sort of *profit* and (ii) if the economic model is *durable*.

Related to *profitability* of the IPR society, stakeholders emphasized that unlike what is normally the case with commercial entities, the goal is not maximizing the profit of RS itself. Instead, RS aims at maximizing the profit of the IPR owners (artists and producers). To this aim, RS seeks for minimizing its internal costs and maximizing the payment to the IPR owners.

Related to the *durability* of their economic model, RS aims at being economically independent, i.e., covering their costs and increase their value. The stakeholders noted that they include their costs in the calculation for repartitioning money to the IPR owners, meaning that the amount of incoming money (clearance fee) is always greater than the outgoing money. This ensures that they remain economically independent.

However, focusing on the *durability* of the economic model for the IPR owners (i.e., artists and producers), the stakeholders highlighted an important point of concern about the timing of payment. Currently, when a track of an artist is played on the radio, the artist will receive the money (for making that track public) approximately one year later. This implies that the artists loose one year of *interest* on their money. The same applies for the producers (e.g., record companies). The stakeholders emphasized that today these payments constitutes a significant part of the income of the producers.

Bottom Line: to ensure economic sustainability of IPR owners the timing of the payments should to be improved.

Openness of actors. From the IT perspective, we assessed to what extent the cross-organizational IT network allows the actors (service providers and consumers) to join and leave the network on-the-fly. In particular, we looked at whether the IT architecture (see Fig. 2) allows for addition of new types of actors.

The stakeholders emphasized that new technological advancements are introducing new type of actors in IPR societies. For example, internet-based technologies have introduced new types of music broadcasting such as Podcasting. Podcasting music allows the precise counting of music use if each listener reports track usage to a counting service. Reporting the music usage can be done through three types of actors (i) music users via their application, (ii) the podcasting music provider, and (iii) a third-party playlist provider. This implies that the IT perspective needs to be open enough to support addition of the new types of actors such as podcasting music provider or playlist provider. What hinders such openness, however, is the lack of use of open standards. Currently, in the IT architecture of IPR e-services the communication between actors is file-based, meaning that they have to agree upon and communicate based on a pre-defined format. A better alternative would be to use open, web-based standards such as WSDL and web service technology. The current IT architecture, however, does not support web service standards.

Moreover, currently IPR handling in many countries is a monopolistic activity as IPR societies are appointed and controlled by the local government. In the near future, however, it is expected that the private entities will be allowed to act as IPR societies. Music users, artists and producers may then select their preferred IPR society for clearance and repartitioning. To fulfill this requirement the IPR societies need to collaborate with each other and even collect fees for international IPR owners, rather than national ones. This introduces a new level of openness enabling actors to change roles and join and leave the IPR service network on-the-fly.

Bottom Line: lack of standardization has hampered the openness for actors which, according to the stakeholders, is absolutely necessary for the future needs of the IPR society.

Consonance between economically sustainable and open actors. In short term, there are trade-offs between the economic sustainability and openness of actors. Enabling the IT perspective to support openness does not come for free and requires significant investments. These investments initially might negatively affect economic sustainability. On long term, however, openness and economic sustainability can be synergic. If the actors are open (e.g. based on standards, web-services and alike), they can more easily, and so more cheaply, interact with IPR users (such as radio stations). Additionally, if international societies interact with each other using standards, it could be easier to exchange rights, payments, and playlist. Thus, more international rights could be cleared against lower costs. Therefore, the total amount of money to be paid increases as (i) increase in number of IPR owners leads to increase in amount of collected money, and (ii) standardization leads to lower costs. Therefore, the increase in amount of collected money and cost reductions results in higher payments to more IPR owners. Consequently, on the long term, there is no trade-off between sustainability and openness, rather they re-enforce each other.

4.2 Services That Are Value Adding and Reusable

Value-adding services From the economic perspective, we assessed whether the services *create value* for the consumers. Simply put, if the services are activities that consumers are willing to pay for. As shown in Fig. 1, there are two commercial services: Clearing and Repartitioning. The stakeholders indicated that two main factors determine the value of IPR services to the IPR owners: (i) high precision in repartitioning calculations, and (ii) maximizing the money being paid to the IPR owners. To ensure high precision, there are important manual actions, although the largest part of the two services is carried out automatically. For instance, matching a played track with the artists is carried out, partially, manually. Such manual operations, although benefiting the precision, however have some disadvantages: they increase human resources costs as more human effort is needed; they require skilled personnel, hence training costs; and they include faults caused by human mistakes (e.g., typos). Since manual operations

have costs, they negatively affect the second value factor, i.e., maximizing the money being paid to the IPR owners.

Bottom Line: although precision in the repartitioning of collected money between the IPR owner is a good motivation for manual operation of some business activities, increasing the level of automation has obvious business benefits.

Reusability of services. From the IT perspective, we assessed if the services are *reused* in various business scenarios, and found that this is not the case for the IPR e-services, although there are many reuse opportunities. for instance, the stakeholders pinpointed that two of the main assets of the IPR society are (i) repository of repertoire information, and (ii) business licenses; with the IPR society's move to internationalization of their services, it becomes essential that the repertoire and licensing data services (i.e., services realizing `:RepertoireInfo` and `:LicenseAdministration` contracts in Fig. 2), are reusable by various international societies and in different business scenarios.

Bottom Line: future scenarios require higher levels of reuseability of services.

Consonance between value-adding and reusable services On one hand, there are trade-offs between high precision in the repartitioning calculations and maximizing the money being paid to the IPR owners. Our discussions with the stakeholders revealed that precision in the calculations is their highest priority. Thus, their current trade-off (semi-automated over fully automated services) remains unchanged. On the other hand, there are trade-offs between reusability and value creation of services, because reusability comes with a price, and decreases the amount of money being paid to the IPR owners.

5 Lessons Learned

In this work we focused on the conflicting requirements between the economic- and IT perspectives and addressed their consonance as the mutual adjustment of those conflicts. In what follows, we discuss our observations related to the application of our approach, lessons learned, and foreseen improvements.

5.1 Exposing Consonance Trade-offs

Observation. We observed that by focusing on the conflicting requirements, our approach makes the implicit trade-offs about consonance of the economic- and IT perspectives explicit. For example, by simultaneously focusing on the economic sustainability and openness of actors, we triggered stakeholders to identify various associated trade-offs. The e^3value and SoaML models are kept deliberately simple to facilitate the tractability and understandability requirements of our approach. We observed that the stakeholders understood the models, and used the two models and their corresponding differences as a starting point for identifying the trade-offs and design problems.

Lesson. In exposing trade-offs our approach showed to be effective. To do so, the used models should only capture the essentials and therefore be easy to understand. The approach directly revealed which conflicting requirements got higher weight, and whether this is desirable. In sum, it led to a lean and to-the-point approach to consonance where the primary focus is on trade-offs.

Improvement. The stakeholders showed interest in having views and viewpoints [9] that are specifically made for their domain. Those viewpoints should frame and highlight the conflicting requirements and visualize their possible prioritization.

5.2 Short-term Consonance Trade-offs Can be Long-term Synergies

Observation. We observed that although, in shorter period of time (e.g., 1 year), some of the conflicting requirements lead to trade-offs, in the long term (e.g., after 5 years) those requirements can be synergic. An example is the economic sustainability and openness of actors (see Section 4.1). Openness comes with a price that is a pressure on sustainability. On the long term, however, openness serves economic sustainability as it maximizes the amount of money to be paid to the right owners.

Lesson. Mainly in the reasoning leading to identification of trade-offs the notion of time remains implicit, although it is inherent in trade-off analysis and decision making [10]. In this work we learned that it is important to turn this situation around by explicitly capturing the timeframe of trade-offs.

Improvement. The stakeholders emphasized the importance of tools and techniques that explicitly capture and visualize consonance trade-offs, over time.

6 Discussion

6.1 Impact of Consonance on Requirements Engineering

Concerning our interpretation of e-services—*commercial* services which are provisioned via information technology—development of e-services obviously requires a software engineering effort, and as part of it, a requirements engineering process. Such a requirements engineering process entails the business development activity, too. This implies that requirements engineering for e-services is not limited to software system requirements only, but should incorporate economic requirements, such as economic sustainability of the e-service at hand for all actors involved also. This is already acknowledged by recent requirements engineering approaches [11], for instance in the field of goal modeling [12]. However, our approach recognizes specific goals such as economic sustainability.

In addition, early exploration of e-services needs development of both economic and IT requirements *in harmony*. IT requirements are important because e-services heavily rely on technology for their provisioning (most digital content services are in fact substantial IT operations). Economic considerations, such

as economic sustainability are important because otherwise the commercial service would not be offered in the first place. Significant trade-offs between these two type of requirements need to be addressed early in the requirements engineering process because both economic sustainability and feasible information technology are needed for the e-service at the same time.

6.2 Related Work

Alignment has been researched in the fields of Requirements Engineering, Business Science, and Computer Science. In what follows we classify a number of recent approaches. What is common among these approaches is that they focus only on *mapping different elements*, and *balancing incompatible objectives* is *not* supported. This implies that the current focus consists of mapping the matching elements, rather than balancing discrepancies and conflicts. This work, to the best of our knowledge, is the first that externalizes the conflicting requirements and makes the trade-offs posed by such conflicts explicit.

Alignment Approaches in Requirements Engineering. Alignment in Requirements Engineering (RE) field is considered a form of requirements engineering. RE acknowledges that different stakeholders are involved, each with a different interest. Thus for proper requirements engineering, multiple perspectives have to be taken [13]—for example, an economic and IT perspective. From a requirements engineering point of view, these perspectives must represent the same system. Or in other words, the perspectives must be aligned [13]. Most of the approaches in RE *map* business elements to IT requirements (e.g., business strategy to requirements [12,14]). Our focus, however, is to treat the discrepancies as first class elements and balance conflicting requirements.

Alignment Approaches in Business Science. An analysis of over 150 articles reveals that most approaches in this field focus on integration between business- and IT strategies and requirements of a *single* enterprise [3]. In recent years, a number of approaches addressed alignment in networked organizations [11,15, 16]. Their IT perspective, however, is scoped down to high-level analysis models only (e.g., business and coordination process models [17]).

Alignment Approaches in Computer Science. Alignment in these approaches entails *mapping* different service-oriented elements. Some link service network- and business process models [18]; while others link business- and software service models [19]. Although the aforementioned approaches appear to be quite different, they all converge to a common perception of "business", i.e., activities or services that are eventually supported by IT services. In this sense, business services are higher-level abstractions of software services, the same as analysis models are higher level abstractions of design models. In practice, however, "business" does not entail higher level abstractions of IT services only. In turn, business might include elements that are in essence inconsistent with their corresponding IT elements. We argue that such simplistic perception of "business" is one of the main sources of confusion which make alignment especially challenging.

7 Conclusion

When Service Orientation was first introduced, many companies perceived it as providing *the solution* for the *old* alignment problem. After a decade, alignment still remains unsolved. Our consonance approach addresses a fundamental issue in the alignment problem: the implicit treatment of the important and difficult trade-offs between the two economic- and IT perspectives. Our approach, which brings the discrepancies and trade-offs into focus, can be adopted incrementally to make adjustments between the conflicting requirements. One way of addressing the consonance trade-offs is to guide the decision making using *conflict-centric architectural viewpoints*. In the requirements exploration phase, it is important to use tractable and easy understandable requirement representation formalisms, due to the limited time available due to the competitive nature of e-service projects, and the broad range of stakeholder interests. To this aim, future work will design viewpoints for aligning economic- and IT perspectives.

In this study we have relied on input and feedback from the stakeholders of IPR to study whether our consonance approach supports their reasoning. The feedback, although informal, has been positive. The consensus was that the models brings attention to what really matters in each perspective, and that the focus on discrepancies help their reasoning for alignment. Future work includes empirical validation of the effects of consonance approach in practitioners' reasoning. This requires engagement of a broad community of practitioners in e-service projects .

A limitation to generalizability of results is that the study was conducted at one company which means the findings are specific to this study. Two aspects, however, mitigate such limitation (i) to cover both economic- and IT perspectives, we chose stakeholders with different roles of he Chief IT and Chief Financial Officer of the IPR society, who hold extensive experience and are aware of requirements of each perspective. (ii) being heavily involved in collaboration with other sister IPR societies in Europe and United States, the stakeholders brought insight from IPR networks in those countries as well. Both aspects play in favor of generalizability of our results.

Acknowledgments. We would like to thank our real-world example provider for the meetings we had and the valuable feedback.

References

1. Derzsi, Z., Gordijn, J.: A framework for business/IT alignment in networked value constellations. In: Proceedings of the Workshops of the International Conference on Advanced Information Systems Engineering, pp. 219–226 (2006)
2. Razavian, M., Lago, P., Gordijn, J.: Why is aligning economic- and IT services so difficult? In: Snene, M., Leonard, M. (eds.) IESS 2014. LNBIP, vol. 169, pp. 92–107. Springer, Heidelberg (2014)
3. Henderson, J., Venkatraman, N.: Strategic alignment: Leveraging information technology for transforming organizations. IBM Systems Journal **32**(1), 472–484 (1993)

4. Yu, E.S.K.: Towards modeling and reasoning support for early-phase requirements engineering. In: Proceedings of the 3rd IEEE International Symposium on Requirements Engineering. RE 1997, pp. 226–235. IEEE Computer Society (1997)
5. Rittel, H.W., Webber, M.M.: Dilemmas in a General Theory of Planning. Policy sciences **4**(2), 155–169 (1973)
6. Gordijn, J., Akkermans, H.: Value based requirements engineering: Exploring innovative e-commerce idea. Requirements Engineering Journal **8**(2), 114–134 (2003)
7. OMG: Service oriented architecture modeling language (SoaML) specification. Technical report, Object Management Group (May 2012)
8. Kazman, R., Klein, M.H., Barbacci, M., Longstaff, T.A., Lipson, H.F., Carrière, S.J.: The architecture tradeoff analysis method. In: ICECCS, pp. 68–78 (1998)
9. International Organization Of Standardization: ISO/IEC/IEEE 42010:2011 - Systems and software engineering - Architecture description. Technical Report March, International Organization for Standardization (ISO) (2011)
10. Razavian, M., Lago, P.: A viewpoint for dealing with change in migration to services. In: Joint Working Conference on Software Architecture & 6th European Conference on Software Architecture, pp. 201–205. IEEE (2012)
11. Wieringa, R., Pijpers, V., Bodenstaff, L., Gordijn, J.: In: Value-Driven Coordination Process Design Using Physical Delivery Models, pp. 216–231. Springer (2008)
12. Singh, S.N., Woo, C.: Investigating Business-IT Alignment Through Multidisciplinary Goal Concepts. Requir. Eng. **14**(3), 177–207 (2009)
13. Finkelstein, A., Kramer, J., Nuseibeh, B., Finkelstein, L., Goedicke, M.: Viewpoints: a framework for integrating multiple perspectives in system development. International Journal of Software Engineering and Knowledge Engineering 2 (1992)
14. Wegmann, A., Regev, G., Rychkova, I., Julia, P., Perroud, O.: Early requirements and business-IT alignment with SEAM for business. In: 15th IEEE International Requirements Engineering Conference. IEEE (2007)
15. Weigand, H., Johannesson, P., Andersson, B., Bergholtz, M.: Value-based service modeling and design: toward a unified view of services. In: van Eck, P., Gordijn, J., Wieringa, R. (eds.) CAiSE 2009. LNCS, vol. 5565, pp. 410–424. Springer, Heidelberg (2009)
16. Chen, H.M.: Towards service engineering: service orientation and business-it alignment. In: Hawaii International Conference on System Sciences. In: Proceedings of the 41st Annual, pp. 114–114. IEEE (2008)
17. Bodenstaff, L.: Managing dependency relations in inter-organizational models. PhD thesis, University of Twente (2010)
18. Danylevych, O., Karastoyanova, D., Leymann, F.: Service networks modelling: An SOA & BPM standpoint. Journal of Universal Computer Science **16**(13), 1668–1693 (2010)
19. Busi, N., Gorrieri, R., Guidi, C., Lucchi, R., Zavattaro, G.: Choreography and orchestration: A synergic approach for system design. Springer, pp. 228–240 (2005)