e^3*forces* : Understanding Strategies of Networked e^3*value* Constellations by Analyzing Environmental Forces

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Abstract. Enterprises increasingly form networked value constellations; networks of enterprises that can jointly satisfy complex consumer needs, while still focusing on core competencies. Information technology and information systems play an important role for such constellations, for instance to coordinate inter-organizational business processes and/or to offer an IT-intensive product, such as music or games. To do successful requirements engineering for these information systems it is important to understand its context; being here the constellation itself. To this end, business value modeling approaches for networked constellations, such as e^3*value* , BMO, or REA, can be used. In this paper, we extend these business value modeling approaches to understand the *strategic rationale* of business value models. We introduce two dominant schools on strategic thinking: (1) the "environment" school and (2) the "core competences" school, and present the e^3*forces* ontology that considers business strategy as a positioning problem in a complex environment. We illustrate the practical use and reasoning capabilities of the e^3*forces* ontology by using a case study in the Dutch aviation industry.

1 Introduction

With the rise of the world wide web, enterprises are migrating from participation in linear value chains [11] to participation in *networked value constellations*. Networked value constellations are sets of organizations who *together* create value for their environment [13]. Various ontologically founded modeling techniques have been developed to analyze and reason about business models of networked value constellations. Some of these are: e^3*value* , developed by Gordijn and Akkermans, showing how objects of value are produced, transferred, and consumed in a networked constellation [4, 5]; *BMO*, developed by Osterwalder and Pigneur, expressing the business logic of firms [10]; and finally, *REA*, developed by Geerts and McArthy, taking an accounting view on the economic relationship between various economic entities [3].

What these techniques however do not consider are *strategic* motivations and goals underpinning a networked value constellation [14]. The mentioned techniques provide a (graphical) representation of *how* a constellation looks like in terms of participating enterprises and *what* these enterprises exchange of economic value with each other, but do not show *why* a business model is as it is. By looking at strategic dependencies and strategic rationales of actors in a constellation, *i* (eye-star)*, developed by Yu and Mylopoulos, *does* take the "why" into consideration [15, 16]. The *i** concepts of "strategic dependency" and "strategic rationale" are however grounded in quite general *agent*-based theories and not in specific *business strategy* theories. To put it differently, well known basic business strategy concepts such as "core competences", "competitive advantage" and "environment" are not considered in *i** explicitly. Our contribution is to add to the existing *business model* ontologies (which formalize theory on networked value constellations, thereby enabling computer-supported reasoning about these) a *business strategy* ontology, based on accepted business strategy theories. An important requirement for an ontology is that it represents a *shared* understanding [1]. By using *accepted* theories we conceptualize a shared understanding of "business strategy" as such. In a multi-enterprise setting, as a networked value constellation is, a shared understanding is obviously essential to arrive at a sustainable constellation.

There exist at least two distinctive, yet complementary, schools on "business strategy". One school considers the *environment* of an organization as an important strategic motivator; the other school focuses on *internal competences* of an organization. The first school originated from the work of Porter [11, 12], and successors [13]. It believes that *forces* in the *environment* of an organization determine the strategy the organization should chose. An organization should position itself such that competitive advantage is achieved over the competition and threats from the environment are limited. The second school considers the *inside* of an organization to determine the best strategy. This school is rooted in the belief that an organization should focus on *core competences* of the organization [7,8]. Core competences are those activities which with an organization is capable of making solid profits [8]. For the continuity of the organization it is best to choose a strategy which focuses on the core competences.

In this paper Porter's five-forces model [11, 12] will be used to create an ontology, named e^3*forces* , which provides a graphical and semi-formal model of environmental forces that influence actors in a networked value constellation. The e^3*forces* ontology will provide a means to reason about strategic considerations (the "why") of a business model in general, and specifically an e^3*value* model [4,5]. So, the e^3*forces* ontology bridges Porter's five forces framework and the e^3*value* ontology by representing how *environmental forces* influence a *business value model*. In future research, we will report on an ontology for the "core competences" strategic school, with the ultimate goal to combine both ontologies to create a more comprehensive business strategy ontology.

The paper is structured as follows. First, to make the paper self-contained, we briefly present the e^3*value* ontology. Second, an industrial strength case study will be introduced, which is used to develop and exemplify the e^3*forces* ontology. Then we present the conceptual foundation of the e^3*forces* ontology. Subsequently, we show, using the ontological construct, how the environment of a constellation may influence actors in this constellation for the case at hand, and we show how to reason with the e^3*forces* ontology. Finally, we present our conclusions.

2 The e^3*value* ontology

The aim of this paper is to provide an ontologically well founded motivation for business value models of networked value constellations in terms of business strategies. Since we use e^3*value* to model such constellations, we summarize e^3*value* below (for more information, see [5]). The e^3*value* methodology provides modeling constructs for representing and analyzing a network of enterprises, exchanging things of economic value with each other. The methodology is ontologically well founded and has been expressed as UML classes, Prolog code, RDF/S, and a Java-based graphical e^3*value* ontology editor as well as analysis tool is available for download (see http://www.e3value.com) [5]. We use an educational example (see Fig. 1) to explain the ontological constructs.

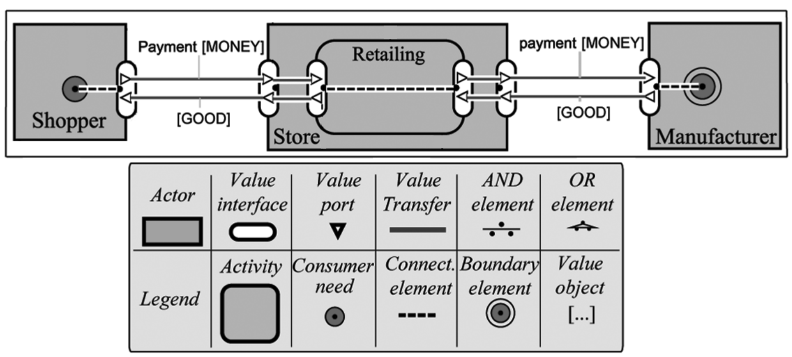

Fig. 1. Educational example

- *Actors* (often enterprises or final customers) are perceived by their environment as economically independent entities, meaning that actors can take economic decisions on their own. The Store and Manufacturer are examples of actors.
- *Value objects* are services, goods, money, or even experiences, 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*, 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, or none at all. So, in the example, Goods can only be obtained for Money and vice versa.
- *Value transfers* are used to connect two value ports with each other. It represents one or more potential trades of value objects. In the example, the transfer of a Good or a Payment are both examples of value transfers.
- *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. In the example, the value activity of the Store is Retailing.
- *Dependency paths* are used to reason about the number of value transfers as well as their economic values. A path consists of *consumer needs*, *connections*, *dependency elements* and *dependency boundaries*. 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 internally, of a same actor. A path can take complex forms, using AND/OR dependency elements taken from UCM scenarios [2]. A dependency boundary represents that we do not consider any more value transfers for the path. In the example, by following the path we can see that, to satisfy the need of the Shopper, the Manufacturer ultimately has to provide Goods.

3 Case Study: Dutch Aviation Constellation

To develop and test the e^3*forces* ontology we conducted a case study at the Dutch aviation industry, in which multiple organizations cooperate to offer flights to, from, and via the Netherlands.

From the large number of actors in the Dutch Aviation constellation we have chosen only key players for further analysis. The key players were identified with the help of a "power/interest matrix" [8]. *Power* is defined as the capability to influence the strategic decision making of other actors [8]. An actor can do so when s/he is able to influence the capacity or quality of the products/services offered by others to the environment. *Interest* is defined as the active attitude and amount of activities taken to influence the strategic choices of other actors. The matrix axis' have the value high and low. Actors with high interest and high power are considered key players [8]. As a result, we identified the following key actors:

- *Amsterdam Airport Schiphol*, hereafter referred to as "AAS", is the common name for the organization NV Schiphol Group, who owns and is responsible for the operations of the actual airport Schiphol. "AAS" 's core business activity is to provide infrastructural services, in the form of a physical airport and other necessary services, to various other actors who exploit these facilities.
- *AirFrance-KLM* This hub carrier is a recent merger between "AirFrance" and "KLM". Because one of the home bases of "AirFrance-KLM" is Amsterdam, they are part of the Dutch aviation industry. "AirFrance-KLM" is

responsible for the largest share of flights to, from and via “AAS”. The core business of “AirFrance-KLM” is to provide (hubbed) air transportation to customers such as passengers and freight transporters.
- *Air Traffic Control*, (hereafter referred to as “ATC”), is responsible for guiding planes through Dutch airspace, which includes the landing and take-off of planes at “AAS”. This service is called “Air Traffic Management”, which is the core business activity of “ATC”.

Fig. 2 shows an introductionary e^3*value* model for the Dutch aviation constellation. “AAS” offers infrastructural services (e.g. baggage handling) plus landing and starting slots to “AirFrance-KLM”, who pays money for this. In addition, “AAS” offers to “ATC” infrastructural services (e.g. control tower), and gets paid for in return (and also gets landing and starting capacity). Finally, “ATC” provides “AirFrance-KLM” with “Air-Traffic Management”, and gets paid in return. We will use this baseline value model to develop and demonstrate e^3*forces* , motivating the value model at hand. A more comprehensive model, *with* the environmental forces, can be found in Fig. 6.

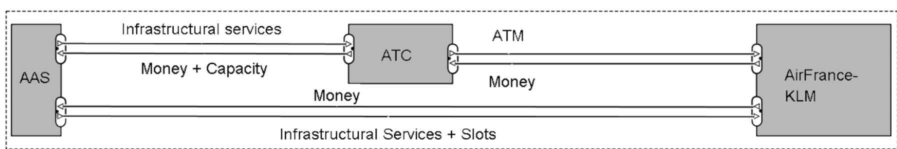

Fig. 2. The Dutch Aviation Constellation

4 The e^3*forces* ontology

The e^3*forces* ontology extends existing business value ontologies by modeling their strategic motivations that stem from environmental forces. Because an ontology is a formal specification of a shared conceptualization, with the purpose of creating shared understanding between various actors [1], most concepts are based on broadly *accepted* knowledge from either business literature (eg. [8,9,11]) or other networked value constellation ontologies (eg. [4, 16]).

Although the e^3*forces* ontology is closely related to the e^3*value* ontology, it also significantly differs. The focus of e^3*value* is on *value transfers* between actors in a constellation, whereas the e^3*forces* ontology considers factors in the *environment* which *influence* the constellation. An advantage of a close relationship between e^3*forces* and e^3*value* is that consistency is easily achieved and both models could be partly derived from one another. Below, we introduce e^3*forces* 's constructs (due to lack of space, we do not show the ontology in a more formal way, such as in RDF/S or OWL):

Constellation. A constellation is a *coherent* set of two or more actors who *co-operate* to create value to their environment [13]. As in e^3*value* , actors are independent economic (and often also legal) entities [8, 9]. Obviously, we need a criterion to decide whether an actor should be in a constellation or not. For each of the actors in the constellation it holds that if the actor would seize its core business, then all other actors would not be able to execute a certain share (roughly 50% or more) of their core business or a certain share would no longer be valuable. The required share expresses the supposed coherence in the constellation. For example, "AAS", "AirFrance-KLM" and "ATC" form a constellation because if one of the actors would seize its activities the other actors would not be able to perform their core business, or their core business would loose its value. In an e^3*forces* model the constellation itself shows up as a dashed box that surrounds the actors it consists of. The actors are related using value transfers, cf. e^3*value* [4, 5].

Market. A constellation operates in an *environment* [8,11] consisting of *markets*. Markets are sets of actors in the environment of the constellation (modeled as a layered rectangle). The actors in a market 1) are *not part* of the constellation 2) operate in the *same industry* as the constellation 3) are considered as *peers*; they offer similar or even equal value objects to the world 4) are in terms of e^3*value* value transfers cf. [4] (in)directly *related* to actors in the constellation [11]. For instance carriers form a market, because they include all carriers not part of the Dutch aviation constellation, have economic relationships with actors in the constellation, are in the same industry and, carriers offer similar value objects to their environment. Note that although "AirFrance-KLM" is a carrier they are not part of the "Carrier" market, because they are already part of the constellation. The organizations are grouped in a market because by considering sets of organizations, we abstract away from the individual and limited [11] influence on actors in the constellation of many single organizations. Therefore, the notion of "market" is motivated by the need to reduce modeling and analysis complexity. By doing so, we consider forces between *actors in the constellation* and specific *markets in the environment*, rather than the many forces between actors in the constellation and each *individual* actor in the environment.

Dominant Actor. A market may contain *dominant actors*. Such actors have a power to influence the market and thus actors in the constellation. If a market is constructed out of a single large organization and a few small organizations, then it is the large organization who determines the strength of a market and is it less relevant to consider the small organizations. Usually dominant actors posses a considerable large share of the market. What is "considerable large" depends on the industry in which the analysis is performed. For instance in the market of operation systems Microsoft (over 70% market share) is a dominant actor, while Toyota can be considered a dominant actor in the automotive industry with only 13% market. Dominant actors are modeled as a rectangle *within* an market.

Submarket. It is possible to model *submarkets* of a market. A submarket is a market, but has a *special type* of value object that is offered or requested from the constellation. For instance, *low cost* carriers are a submarket of the *carrier* market. A submarket is shown in the interior of a market.

Industry. An industry unites all actors shown in an e^3*forces* model. So, the actors of the constellation, and actors in a (sub)market are all in an *industry.*

Force. Markets in the environment of a constellation influence actors in the constellation, by exercising a *force*, this is expressed by a “strength” arrow. Such an arrow is shown near an e^3*value* value transfer. In the following sections, we illustrate specific forces, as derived from Porter’s five forces model [11].

5 Modeling Porter’s five forces using e^3*forces*

Using the e^3*forces* ontology, we model various forces between actors and markets. Porter distinguishes five kinds of forces [8, 11, 12]: *bargaining power of suppliers*, *bargaining power of buyers*, *competitive rivalry among competitors*, *threat of new entrants* and *threat of substitutions.*

5.1 Bargaining power of suppliers

Suppliers are those organizations which are part of the environment of a constellation (because they do not satisfy the previously discussed “coherence” criterion) and *provide* value objects to actors in the constellation [8]. For the case at hand, suppliers are e.g. “Airplane Manufacturers”. Suppliers influence actors in a constellation by threatening to alter the configuration of goods/services, to increase the price or to limit availability of products [8, 11]. These are changes related to the value objects and/or their transfers between actors and their environment. So, a first step is to elicit (important) suppliers for each actor part of the constellation. Suppliers are identified by finding organization which *provide* value objects *to* the constellation, but who are *not* part of the constellation.

Next the strength of the bargaining power of the suppliers in relationship to the actors in the constellation must be analyzed. According to [11], five factors determine the strength of a supplier market: 1) *The concentration of (dominant) suppliers.* Suppliers are able to exert more influence if they are with few and when buyers are fragmented. 2) *The necessity of the object provided by the suppliers.* If the value object is essential then the actors in the constellation can make less demands. 3) *The importance of actors in the constellation to the suppliers.* If actors in the constellation are not the supplier market’s main buyer, then the supplier is stronger. 4) *The costs of changing suppliers.* If the costs are high, then actors in the constellation are less likely to choose another supplier, which give the supplier more strength. 5) *Threat of taking over an actor in the constellation.* The supplier might plan to take over an actor in the constellation to strengthen its position in the environment.

Using these questions, the relative strength of the power of a supplier market is determined for each transfer (connected to an actor in the constellation), and is shown as a *strength arrow* along the lines of the connected value transfers (which are the transfer of the value object provided by the supplier market to the actor in the constellation *and* the transfer of the value object provided as a compensation (e.g. money)). Note that since we model the power the supplier market exercises over an actor in the constellation, the strength arrow always points from the supplier's interface of the market *toward* the buyer interface of the actor in the constellation. The relative strength of the arrow is based on the analysis of the supplier market given above. Also note that a market can be a *supplier* market, a *buyer* market, a *competition* market or any combination, since markets can have *supplier interface(s)* and/or *buyer interface(s)*, depending on the role. A supplier interface is, via value transfers, connected to a buyer interface of an actor in the constellation.

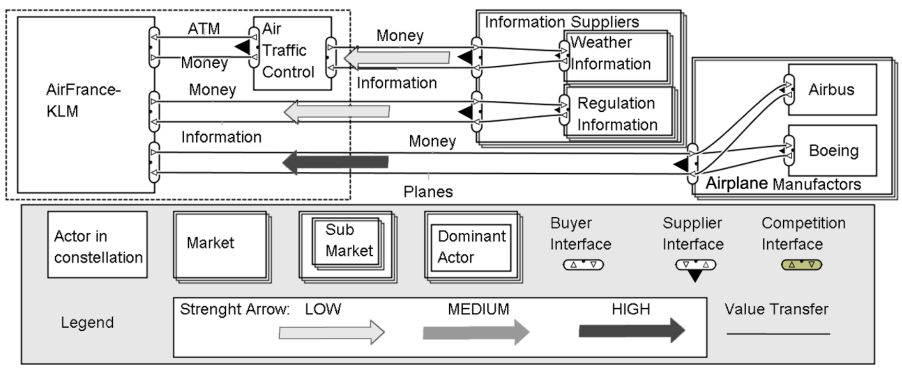

Fig. 3. e^3*forces* :Suppliers

Fig. 3 demonstrates some supplier forces for the case at hand. For example "Airplane Manufacturers" is a supplier market to "AirFrance-KLM", having two dominant actors: "Boeing" and "Airbus". This market exercises a power of *high* strength because: a) there is a concentration of dominant suppliers, b) the value object is essential to "AirFrance-KLM", and c) "AirFrance-KLM" is only one of many buyers. Due to lack of space, we can not explain each power relation in a more detailed way.

5.2 Bargaining power of buyers

Buyers are environmental actors that *acquire* value objects from actors in the constellation [8]. Buyers can exercise a force because they negotiate down prices, bargain for higher quality, desire more goods/services and, try to play competitors against each other [11, 12]. All this is at the expense of the profitability of the actors in the constellation [11, 12]. Buyer markets have value transfers with actors in the constellation similar to supplier markets.

After eliciting possible buyer markets, the strength of the power they exercise is analyzed. According to [11], seven factors determine the strength of buyer markets: 1) *The concentration of (dominant) buyers.* If a few large buyers acquire a vast amount of sales, then they are very important to actors in the constellation, which gives them more strength. 2) *The number of similar value objects available.* A buyer market is stronger, if there is a wide range of suppliers from which the buyer market can chose. 3) *Alternative resources of supply.* If the buyer market can chose between many alternative value objects then the buyer market is powerful. 4) *Costs of changing supplier.* If costs are low, then buyers can easily choose another supplier, which gives the buyer market strength. 5) *The importance of the value object.* If the value object is not important to the buyer market, it is harder for actors in the constellation to maintain an economic feasible relationship. 6) *Low profits.* The actors in the constellation have to sell large volumes to make profits, giving the buyer market more bargaining power. 7) *Threat of taking over an actor in the constellation.* A buyer is willing and capable to purchase an actor in the constellation, which the purpose to strengthen its own position.

Similar to supplier markers, by using these questions, the relative strength of the power of a buyer market is determined for each transfer (connected to an actor in the constellation), and is shown as a *strength arrow* along the lines of the connected value transfer.

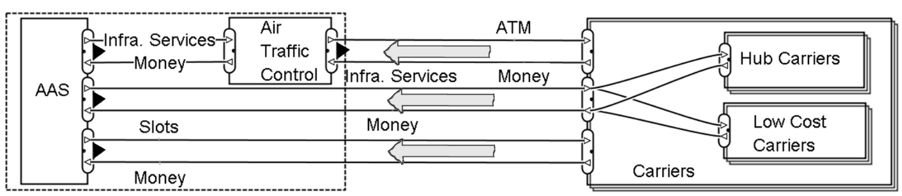

Fig. 4. e^3*forces* : Buyers

In Fig. 4, two actors of the constellation are given: “AAS ”and “ATC”. One buyer market (carriers) is modeled, in which two submarkets are present (“Hub Carriers” and “Low Cost Carriers”). “ATC” provides a service to the entire carrier market, resulting in a low strength. “AAS” provides “Infrastructural Service” to “Carriers”, but these services slightly differ for “Hub Carriers” and “Low Cost Carriers”. Consequently, both submarkets are connected to the buyer interface of the entire market. This buyer market is in turn connected to the supplier interface of the “AAS”.

5.3 Competitive rivalry among 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 [8]. 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 [11, 12].

So far, forces exercised by markets on actors in the constellations have been expressed along the lines of *direct* value transfers between markets and actors. Such a representation can not be used anymore for modeling competitive rivalry. In case of competitive rivalry, (competitive) markets aim to transfer same value objects to the same buyer markets as the actors in the constellation do. Consequently, competitive rivalry is represented as: a) value transfers of a constellation's actor to a *buyer* value interface of a (buyer) market, *and* b) *competing* transfers of a competition market to the *same* buyer interface of the market. The extent of competitive rivalry is expressed by incorporating a *strength arrow* that points from the competition market toward the *buyer market*. This is because competitive rivalry, as expressed by the strength arrow, is located at the *buyer market*, and *not* at the actor in the constellation [11]. The buyer interface of a market for which competition occurs is called the "competition" interface, and is explicitly stated. Also, it is worthwhile to show dominant actors for a competitive market; these are considered the most important competitors.

To decide upon the strength of the competitive force, seven factors are used [11]: 1) *The balance between competitors*. If competitors are equal in size, strength and market share, then it is harder to become a dominant actor, which leads to more rivalry. 2) *Low growth rates*. If industry growth rates are low then competitors have to make more effort to increase their own growth rates, which leads to higher competitive rivalry. 3) *High fixed costs for competitors*. This can result in price-wars and low profit margins, which increase competitive rivalry. 4) *High exit barriers*. In this case competitors cannot easily leave the market. To remain profitable they will increase their effort to increase or maintain their market share. 5) *Differentiation between competitors*. If there is no difference between value objects offered by competitors, then it is harder to sell value objects to customers. 6) *Capacity augmented in large increments*. This can lead to recurring overcapacity and price cutting. 7) *Sacrificing profitability*. If actors are willing to sacrificing profitability to increase market share and achieve strategic goals, other organization have to follow; leading to more competition. [11].

Fig. 5 shows that the constellation "AirFrance-KLM", has two buyer markets; "Freight Transport" and "Passengers". In the competition market "Carriers" a *submarket* is modeled and a *dominant actor*. The submarket "Hub Carriers" is connected with its own supplier interface, and via an interface of the total market, to the buyer market "Freight Transport". This indicates that this *submarket* is responsible for the competitive rivalry at the buyer market and *not* the entire carrier market. Furthermore, the dominant actor modeled, "EasyJet", is connect to the "Passengers" buyer market. This indicates that this particular actor is

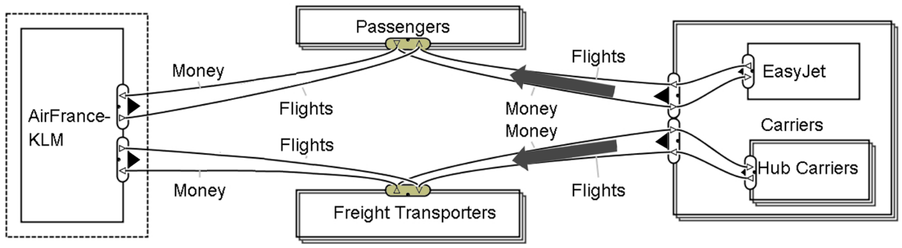

Fig. 5. e^3*forces* : Competitors

responsible for a large amount of the competitive rivalry at the "Passengers" buyer market.

5.4 Threat of new entrants

Potential *entrants* are actors who *can become* competitors, but who are currently *not*, or who do not exist yet [8, 11]. Consequently, we consider new entrants as a *future* competitive market. To determine the threat of a potential entrant, the following aspects need to be analyzed [11]: 1) *Economies of scale.* If economies of scale are needed to become profitable, then the threat is determined by the economic of scale a potential entrant can achieve. 2) *Capital required.* If a substantial capital is required to enter an industry, the threat is determined by the extent to which the potential entrant has the capital required. 3) *Access to distribution channels.* If there is limited access to distribution channels, the threat of a potential entrant is lower. 4) *Experience and understanding of the market.* If both are needed to be profitable and the potential entrant has neither, then the threat is low. 5) *Possibility of retaliation.* If existing organizations in an industry can retaliate against entrants with the goal to force them out of the industry. 6) *Legal restraints.* If laws and regulations place boundaries on potential entrants, then the threat of a potential entrant is low. 7) *Differentiation.* If it is hard for a potential entrant to differentiate from existing organizations, they will less likely make profits and therefore pose a low threat.

Potential entrants are modeled (as rounded squares) *within* a competitive market and labeled after the potential entrant. Furthermore, the potential entrant has a supplier interface which is connected to the relevant supplier interface of the competition market. The threat of a potential entrant is expressed by a strength arrow, which originates at the potential entrant and point toward the supplier interface of the entire competition market. The strength of the arrow is based on the analysis of potential entrants given above.

5.5 Threat of substitutions

Actors may offer *substitutions*, so different value objects, to a buyer market, yet satisfy the same need of the buyers [8, 11]. Substitution markets are seen as competitive markets who offer different value objects, as an alternatives to objects offered by actors in the constellation, to the *same* buyer markets. Substitution markets are modeled in the same way as competition markets, but value objects of actors in the constellation and of the substitution markets differ. In brief, the strength of the arrow is determined by the likelihood that the substitution will reduce the market share of the constellation for this buyer market [11, 12].

6 An e^3*forces* model for the Dutch aviation industry

Fig. 6 shows an e^3*forces* model for the Dutch aviation constellation. It first shows how the key actors are internally and externally connected in terms of e^3*value* value transfers. Furthermore, the strengths of the forces that influence the (actors in the) constellation are shown. A number of small suppliers, who have low strength, are grouped into "supplier" markets for space purposes.

At a first glance, the model shows that environmental forces have the least impact on "ATC". Moreover, "ATC" does not have any competitors. Second, the model shows that "AAS" mostly acts as a provider and that environmental forces have a low impact on "AAS": most forces have low strength. The third actor, "AirFrance-KLM", has to deal with the strongest forces. This is due to the competitive rivalry at the buyer markets of "AirFrance-KLM".

6.1 Reasoning with e^3*forces*

The aim of the e^3*forces* ontology is to motivate a business value model (e.g. an e^3*value* model) in terms of environmental forces. Is this possible? If we analyze the e^3*forces* model we see that "AirFrance-KLM" is mostly and heaviest influenced by forces in the environment. From the model, it can be seen that this is due to high competitive rivalry at their buyer markets. Following Porter [11,12], an option to be profitable is then to reduce costs per unit through economic of scale (e.g. increasing capacity). By consulting the e^3*forces* model, we can see that the capacity of "AirFrance-KLM" however depends on services of "AAS" and "ATC".

To facilitate dependency-tracing reasoning (see e.g. $i*$ [15,16] and e^3*value* [5] for examples of such reasoning), we add to the e^3*forces* model a *dependency relation* between interfaces of a same actor. Such a dependency relation states that, if objects are transferred via an interface, objects should also be transferred by the dependent interface. Following the dependency relations in the interior of "AirFrance-KLM", it can be seen that "AirFrance-KLM" depends on "AAS" for two value objects (and that "AAS" in turn depends for one of these objects on "ATC"). Additionally, since "AirFrance-KLM" is responsible for over 50% of the flights to/from "AAS", it is clear why there is such a high dependency between these actors and why they are in a networked value constellation at all.

The e^3*forces* model also explains why "AirFrance-KLM", "AAS" and "ATC" are not just a single enterprise (legal barriers not considered). "AirFrance-KLM" only accounts for 50% of the flight to, from and via the Netherlands. "ATC"

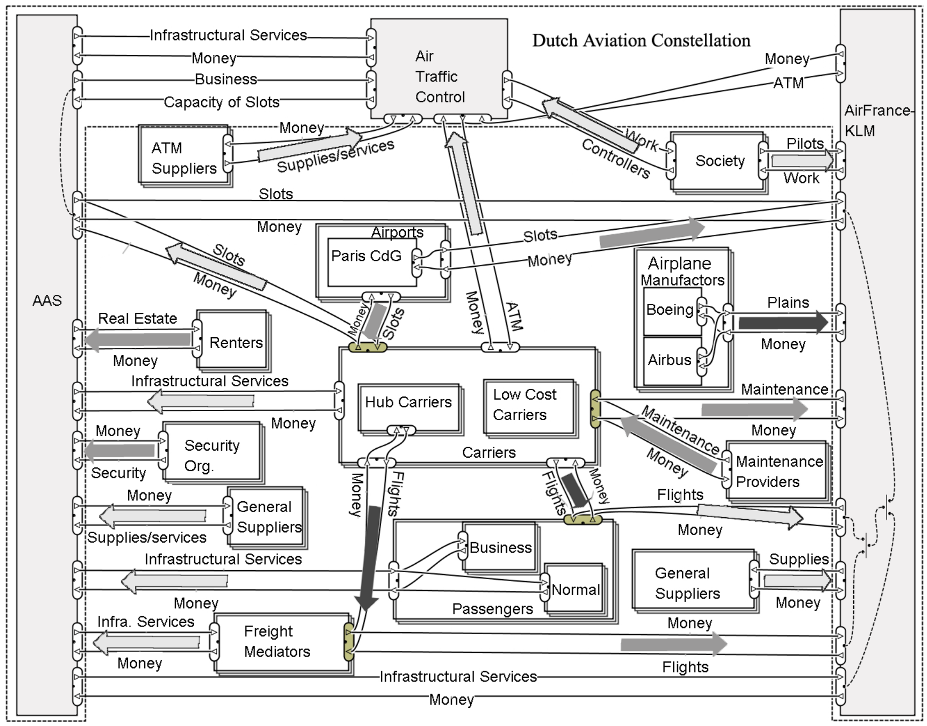

Fig. 6. e^3*forces* : Complete

and "AAS" create additional profits by offering their services to other buyers. To avoid conflicts of interest, which might lead to less business or lower quality/safety, the actors in the constellation remain independent actors.

6.2 Practical use of e^3*forces* for information systems

Information systems analysts can use strategic analysis methods, such as e^3*forces* and c3-value [14], for a better understanding of their organization and design processes and IT accordingly [14]. In addition, an important aspect of a strategy is to strive for competitive advantage [8, 12]. Competitive advantage, roughly defined as "to be able to do something better then the competition" [8,12], can be achieved by choosing a better positioning in the environment. As of today, information technology plays a key role in doing so, e.g. by improving supplier relations, buyer relations and differentiating from the competition [8, 12]. IT, for instance in the form of supply chain management systems, is able to reduce supplier costs, improve supplier relations and therefore contribute to competitive advantage. The same can be said for buyer markets. An example taken from the aviation industry is the e-ticket system. This system highly depends on IT, but is able to reduce costs and buyer markets can acquire tickets faster and cheaper. An e^3*forces* model helps by determining at which places IT can create competitive advantage by providing a graphical overview of relationships with markets.

7 Related work

Closely related to this research is the work performed by Weigand, Johannesson, Andersson, Bergholtz, Edirisuriya and Ilayperuma [14]. They propose the c3-value approach in which the e^3*value* ontology [4,5] is extended to do competition analysis, customer analysis and to do capabilities analysis. They, however, do not provide a complete set of constructs or methodologies for the three models. Therefore the models are currently quite abstract and give rise to both modeling and conceptual questions. Furthermore, the authors seem to focus more on the composition of value objects (in terms of second order value transfers), than on the *strategic motivation* for a business value model.

Also related to this research is the work done by Gordijn, Yu and Van der Raadt [6]. In this research, the authors try to combine e^3*value* and *i**, with the purpose to better understand the strategic motivations for e-service business models. The e^3*value* model is used to analyze the profitability of the e-services; *i** is used to analyze the (strategic) goals of the participants offering/requesting the e-services. The e^3*forces* ontology adds a specific *vocabulary* on business strategy, which is lacking in both e^3*value* and *i**.

8 Conclusion

With the aid of an industrial strength case study we were able to create an ontology for modeling and analyzing the forces that influence a networked value constellation. By using the e^3*value* ontology and Porter's Five Forces framework as a basis, we used existing and accepted knowledge on networked value constellations and environmental influences on business strategies to create a solid theoretic base for the e^3*forces* ontology. This solid theoretic base enabled us to reason about the configuration of networked value constellations; as demonstrated by the case study. In this study we presented a clear model of 1) the value transfers *within* the constellation, but more important: 2) the value transfers *between* actors in the constellation and *markets* in the *environment* of the constellation and, 3) the *strength* of forces, created by the markets, which influence actors in the constellation. Via this model and strategy theories we were able to use semi-formal reasoning to explain dependencies between actors. In addition we were able to analyze the position and roles of the actors in the constellation. This enabled use to reason about the configuration of the networked value constellation by considering the question of "Why".

The e^3*forces* ontology is a step to arrive at a more comprehensive e^3*strategy* ontology which can be used to capture the business strategy goals of organizations in networked value constellation. In future research, we complement

e^3*strategy* with a more *internal competencies*-oriented view on the notion of business strategy.

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