

Purpose Driven Value Model Design

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Abstract. It is increasingly recognized that value models offer an abstraction that is useful for the exploration of new business networks and their properties. Among others, value models can be used as input for a risk analysis that is crucial in cross-organizational business process design. However, as value models can be used for many different purposes, there is a risk that they become overloaded and difficult to understand. In this paper we claim that the form and contents of a value model should be governed by its purpose. We identify a number of basic purposes of value models and outline how a value model is affected by those. The approach builds on an analysis and classification of resources and resource exchanges.

1 Introduction

Meeting changing customer demands and creating new opportunities makes it necessary for businesses to constantly re-invent themselves and for this end modeling the business is an important means. There is an increased recognition that when creating models of new business processes or redefining old ones, the right point of departure in the analysis is not the business processes themselves but notions at a higher level of abstraction. The abstraction can be achieved by focusing on the essential communicative acts [1] rather than the specific message exchanges, on functional and non-functional goals rather than the way they are achieved [2], on commitments and obligations [3] rather than the way these are fulfilled, or on the business models behind a process. Models on this level of abstraction are known as value models.

Value models have a special characteristic in that they are formulated declaratively with little or no concern for the order of activities taking place or other forms of dependencies. They can be used for a number of different purposes, including the following ones:

- Profitability analysis. A value model can be used for determining the financial profits gained by each actor participating in a value network, thereby ensuring the sustainability of the network. The profitability analysis is based on the volumes and monetary values of the resource exchanges.
- Benefit analysis. A benefit analysis is similar to a profitability analysis but takes a broader perspective by considering not only monetary values but also more intangible resources like knowledge and reputation.

- Business process design. A value model can be a starting point for designing business processes. The resource exchanges of the value model will form a basis for identifying the business processes required for realising the value network.
- Marketing analysis and design. A value model can be used for representing and reasoning about the customer needs and wants that are addressed by the resource exchanges of the value network.

As value models can be used for many different purposes, there is a risk that they will become overloaded and difficult to understand. Therefore, we suggest that when designing a value model, its goal or purpose should be explicitly stated and used for guiding the design choices made. In particular, the kinds of resources included in the value model will depend on the purpose of the model and one main objective is to propose a classification scheme for resources and relate that to modeling purposes. In this paper we look at value models and value modeling practice through an investigation of one particular kind of value model – the e3value [4]. This investigation will make it evident that having resource exchanges of several different kinds in an e3value model makes it less clear than focusing on one or a few kinds.

The paper is structured as follows. In Section 2, we describe a number of approaches to value modeling. In Section 3, we introduce a motivating example that illustrates the problems with overloaded value models. In Section 4, we propose a classification of different kinds of resources and resource exchanges relevant for value models with different purposes. We also suggest some guidelines for the design of value models taking their purposes into account. In Section 5, we continue with remake of the running case. Finally, in Section 6 we conclude with a general discussion and suggestions for further work.

2 Value Models

There exist a number of approaches, languages, and ontologies for business modeling in literature, e.g., [1], [3], [4] and [5]. In [6] the e3value [4] and the REA ontologies [3] were compared (together with a third business ontology – the BMO [7]) in order to establish a common reference business ontology. One result of that comparison was a set of mappings between e3value and REA indicating strong similarities between the concepts of the two. Both REA and e3value were originally designed for capturing tangible exchanges of economic resources between actors. Verna Allee [8] transcends or complements this view by also proposing to include intangible exchanges as well. Examples of resources transferred through intangible exchanges are knowledge or status.

The Resource-Event-Agent (REA) ontology was formulated originally in [3] and has been developed further, e.g. in [9] and [10]. Its conceptual origins can be traced back to traditional business accounting. REA was originally intended as a basis for accounting information systems and focused on representing increases and decreases of value in an organization. REA has been extended to form a foundation for enterprise information systems architectures [11], and it has also been applied to e-commerce frameworks [10].

The core concepts in the REA ontology are Resource, Event, and Agent. The intuition behind the ontology is that every business transaction can be described as an event where two agents exchange resources. To acquire a resource an agent has to give up some other resource. For example, in a goods purchase a buying agent has to give up money in order to receive some goods. The amount of money available to the agent is decreased, while the amount of goods is increased. Conceptually, two events are taking place: one where the amount of money is decreased and another where the amount of goods is increased. This combination of events is called a duality and is an expression of economic reciprocity – an event increasing some resource is always accompanied by an event decreasing another resource. A corresponding change of availability of resources takes place at the seller’s side. Here the amount of money is increased while the amount of goods is decreased. There are two types of events: exchanges and conversions [11]. An exchange occurs when an agent receives economic resources from another agent and gives resources back to that agent. A conversion occurs when an actor consumes resources to produce other resources. Events often occur as consequences of existing obligations of an actor; in other words, events fulfill the commitments of agents.

The e3value value ontology [4] aims at identifying exchanges of resources between actors in a business case and it also supports profitability analyses of business cases. The ontology was designed to contain a minimal set of concepts and relations to make it easy to grasp for its intended users. e3value includes a graphical notation for business models. The basic concepts in e3value are actors, resources, value ports, value interfaces, value activities and value transfers (see Fig. 1).

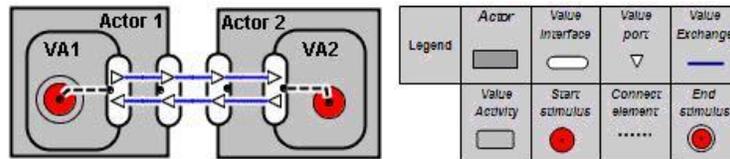


Fig. 1. Basic e3value constructs

An actor is an economically independent entity. An actor is often, but not necessarily, a legal entity, such as an enterprise or end-consumer or even a software agent. A set of actors can be grouped into a market segment. A resource (also called value object) is something that is of economic value for at least one actor, e.g., a car, Internet access, or a stream of music. A value port is used by an actor to provide or receive resources to or from other actors. A value port has a direction: in (e.g., receive goods) or out (e.g., make a payment), indicating whether a resource flows in to or out from the actor. A value interface consists of in and out ports that belong to the same actor. Value interfaces are used to model economic reciprocity and bundling. A value exchange represents one or more potential trades of resources between these value ports. A value activity is an operation that can be carried out in an economically profitable way for at least one actor.

Both the e3value and the REA ontologies include concepts on the operational level as well as the knowledge level [12], where the operational level models concrete, tangible individuals in a domain, while the knowledge level models information

structures that characterize categories of individuals at the operational level. In REA almost all classes on the operational level have a corresponding class on the knowledge level, which is generally not the case for e3value. The REA ontology distinguishes between event type (abstract transfer of categories of resources) and event (actual transfer of tangible concrete resources), both of which correspond to e3value's value transfer. The economic reciprocity between two REA events is modeled through the duality relationship, while the same reciprocity between value transfers in e3value is accomplished by bundling the value transfers through value interfaces.

The distinction between tangible and intangible exchanges of resources has been investigated by Verna Allee. Tangible exchanges are established and explicitly regulated in contracts. They correspond to exchanges of economic resources in the REA ontology and e3value. Intangible exchanges are established informally and their terms are not present in contracts. As stated in [8], "Intangible knowledge and information exchanges flow around and support the core product and service value chain, but are not contractual. Intangibles include those "little extras" people do that help keep things running smoothly and build relationships. These include exchanges of strategic information, planning knowledge, process knowledge, technical know-how, collaborative design work, joint planning activities, and policy development." There is no formal correspondence between an intangible exchange and any concept in REA or e3value.

3 A Motivating Example

For illustrative purposes and as a running example we introduce a fictive but realistic business scenario from the health care domain, including actors such as hospitals, patients, and medical equipment providers. It is constructed to highlight some problems related to exchanges of resources that a business analyst or modeler often encounter. In this section we make an initial model which is further refined in the fifth section.

Scenario description

The Hospital purchases medical equipment from the Medical equipment providers by placing Orders and paying Cash. Furthermore, the Hospital acquires Product knowledge through their interactions with the Medical equipment providers.

The Sales agents assist the Medical equipment providers to acquire new customers, i.e. they market the products of the Medical equipment providers, negotiate with potential customers and deliver valid Customer orders to the providers. Through participating in this interaction, the Sales agents will get Product knowledge from the providers, while the latter will get Market knowledge from the Sales agents.

The Patients receive Health care services from the Hospitals such as examinations and treatments. These services will improve the Health state of Patients but also their Knowledge about their health conditions as well as their Feeling of safety. The Hospitals will get Cash from the Patients but also improved Medical knowledge by

examining and treating complex cases. The Government collects tax from citizens in order to provide health care for all.

The Hospitals also interact with the Government providing Health care services and receiving Cash in return. Furthermore, the Government gives the Hospitals access to the market by providing Authorization. The Hospitals may participate in Professional communities with which they exchange Knowledge. A Professional community will also get the Attention of the Hospital. Through its participation the Hospital will earn Status.

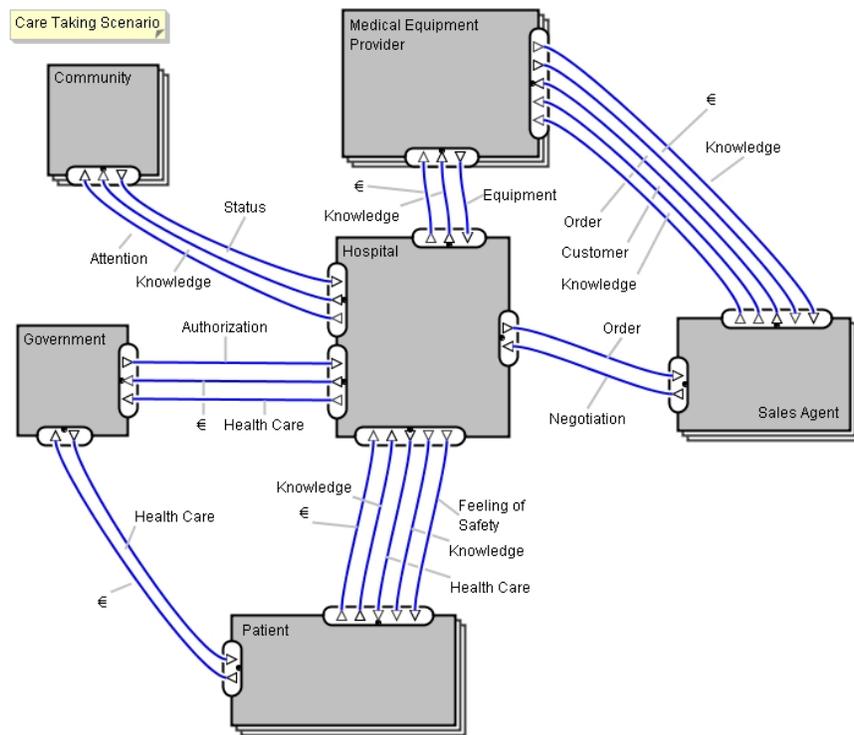


Fig. 2. Initial value model of the Care Taking Scenario

Analysis

The value model in figure 2 is produced from the case description. It is a value model built using the typical modeling heuristics (1) who are the actors? (2) what is each actor offering and to whom? (3) what will the actors get in return? As seen, the resources (value objects) included in this example model are highly heterogeneous, and it can even be questioned whether all of them should be viewed as resources. The following observations can be made:

- *Orders*. Orders are quite different from resources like goods, as they express commitments to deliver other resources. It can be questioned whether they should be classified as resources, since they are not valuable by themselves but only through their relationships to other resources. It can be argued that an order should not be considered a resource as it is a commitment (a promise) to exchange something with someone, but, on the other hand, promises of deliveries can be bought and sold for instance at futures exchanges. In any case, an order as discussed here should not be confused with an order placement which is an event.
- *Feeling of safety*. Feeling of safety, although being of value is something that cannot be transferred from one actor to another. Instead it is inherent to a single actor. Therefore, it might not be appropriate to view it as a resource of a value transfer.
- *Knowledge*. The comments for Feeling of safety also apply to Knowledge (including Market Knowledge and Product Knowledge).
- *Status*. Similarly to Feeling of safety and Knowledge, Status cannot be transferred from one actor to another. However, a difference is that status is not inherent to a single actor but rather expresses a relationship between one actor and a number of other actors.
- *Attention*. Attention can be viewed as an economic resource, as it is something provided by one actor to another. Sometimes it is paid for or sold to third parties.

Another issue is what is meant by the value transfers of the model. Most of the transfers mean that some right on a resource is transferred from one actor to another, in accordance with [11][13]. However, some of the transfers cannot be interpreted in this way:

- Customer orders from Sales agent to Medical equipment providers. In this case, the Sales agent has never had any rights on the Customer orders, so he is not able to transfer any right on them. The role of the Sales agent is only to be a matchmaker, enabling the Medical equipment providers and the Hospital to discover each other and establish a relationship in the form of an order. In other words, the Sales agent, as modeled in figure 2, provides a negotiation service on behalf of one of the parties and also delivers information about the outcome. However, the order-payment commitments are parts of a bilateral relation between the Medical equipment providers and the Hospital.

4 Classifications of Resources and Exchanges

In this section, we introduce a simple classification of resources into three categories: economic resources, internal resources, and shared resources. The classification is based on the degree to which a resource is tied to an actor. While an internal resource is existence dependent on an actor, an economic resource is controlled by an actor but can be transferred to another, and a joint resource is not under the control of any single actor. Furthermore, we distinguish between three kinds of exchanges: formal exchanges, informal exchanges, and emergent exchanges. These are based on the degree of formality and intentionality of the exchanges. Formal exchanges are based on contracts, informal exchanges are performed outside contracts, while emergent exchanges occur as a result of participating in a network.

Resources

Economic resources. An economic resource is a resource that can be under the control of a single actor, in the sense that the actor may have transferable legal rights on the resource. These rights may then be transferred from one agent to another, e.g. the ownership right on a book may be transferred from a bookseller to a customer. Some typical examples of economic resources are cars, computers, paintings, music, theater performances, air travels, and stamps. Actors may have legal rights on each of these resources and these rights can be transferred to other actors. A first attempt to classify economic resources is the following:

- Goods, which are physical objects, like buildings, petroleum, cars, refrigerators, and cell phones.
- Information, which is data in a certain context, like blueprints, musical scores, poems, and customer databases. What is transferred is usually a physical representation plus (most importantly) certain usage rights on the information.
- Labour, which is physical or intellectual work done by people.
- Services, which are economic resources that encapsulate other resources and are used to increase the value of some other resource.
- Funds, which are media for exchange. Funds include money, vouchers, and marketable securities. A voucher is a certificate that can be exchanged for another specific economic resource, e.g. a good or a service. Usually, a voucher can be exchanged only at some pre-specified actor(s). Money can be viewed as the most general form of voucher without restrictions on economic resources and actors.

Internal resources. An internal resource is a resource that is internal to an actor in the sense that the actor can use the resource but is unable to transfer any rights on it. Examples of internal resources are:

- Knowledge. At first sight, it might seem that knowledge is possible to transfer from one actor to another. However, this cannot be done directly, but only through an intermediary economic resource, e.g. a book (goods) or a lecture (service).

- Processes, practices, and procedures. The ways of working of an organisation are important resources, but they are typically so closely tied to the organisation that they cannot be traded.
- Experiences. Experiences of an individual can be viewed as resources, but they are not economic resources, as they cannot be transferred from one actor to another.

Joint resources. A joint resource is a resource on which rights cannot be transferred and that cannot be controlled by a single actor but only by multiple actors. Examples of joint resources are:

- Relationships. Relationships are important resources, but they are not under the control of a single actor and are, therefore, not economic resources. For example, an actor cannot transfer his web-of-contacts to another actor but he can provide access to it. He doesn't own his network but is a part of it.
- Organisations. Some organisations, such as companies are economic resources that can be bought and sold. However, many other organisations, e.g. churches and unions, cannot be traded.
- Networks and societies. On a larger scale, networks of actors and societies can also be viewed as resources, but they are not economic resources as they cannot be controlled by any individual actor.

Analysing the resources occurring in the running case, we note that most of the resources are economic resources, except for the following:

- Customer orders. An order is a contract between partners, i.e. a kind of relationship, a joint resource.
- Status. A joint resource. The status of a hospital relative other hospitals is increased as it participate in a high status care taking Community. One must also assume that the status of the community relative other communities is increased if a participating hospital has high status. The high status emerges from the two actors' relation.
- Feeling of safety, knowledge, health status. These are internal resources.

Exchanges

Formal exchanges. Formal exchanges are contractual transactions including goods, services, contracts, invoices, requests for proposals, confirmations, and payments (similar to tangible exchanges in [8]). Any economic resource, including information, can be the object of a formal exchange.

Informal exchanges. Informal exchanges are carried out in relationship to formal exchanges but not regulated by contracts. Examples are extra services such as deliveries in advance or exchange of strategic information. Those are intangible exchanges in Allee's terms [8].

Emergent exchanges. Emergent exchanges are not carried out explicitly or intentionally by an actor. Instead, an emergent exchange occurs as a result of other

exchanges, i.e. an emergent exchange is the result of interactions in a value network. For example, by participating in a network, an actor will automatically gain knowledge about products and markets, and these are viewed as emergent exchanges.

Summarising, an actor can benefit from participating in a value network in three ways: by getting resources from other actors through formal exchanges, by getting resources from others in informal ways, or by getting resources as a result of interactions in the network. Table 1 puts the analysis in a concise format.

Table 1. Types of resources and quality of resource exchanges

		Quality of Exchange		
		Formal	Informal	Emergent
	Economic	Exchanges of economic resources according to contracts - Goods deliveries, payments	Exchanges of economic resources outside contracts - Extra services, bonus deliveries	N/A
Resource	Internal	Internal resources gained by using resources obtained in formal exchanges - Knowledge, feeling of safety	Internal resources gained by using resources obtained in informal exchanges - Knowledge, feeling of safety	Knowledge and experience from interactions - Market knowledge, product knowledge
	Joint	Establishing and upholding formal relationships - Order creation	Establishing and upholding informal relationships - Goodwill creation	Establishing and upholding informal relationships - Status creation

Guidelines for a Purpose Based Value Model Design

Table 1 can be used for deciding what aspects to focus on when designing a value model for a specific purpose. We give four examples:

Profitability Analysis. A profitability analysis is based on the volumes and monetary values of resource exchanges in a value network. Its purpose is to check that the value network is sustainable in the sense that all participants make a financial profit. For

this purpose, a value model should focus on economic resources in formal exchanges. The financial profits are directly dependent only on economic exchanges though other kinds of resources indirectly may influence the profit. Furthermore, a financial analysis can only take into account formal exchanges as other kinds of exchanges are difficult to value in monetary terms.

Benefit Analysis. A benefit analysis is wider than a profitability analysis as it also addresses other kinds of resources than economic ones. Thus, economic as well as internal and joint resources are of interest in a benefit analysis. Potentially, also all kinds of exchanges are of interest. In most cases, formal and informal exchanges are the most important ones, but if an actor enters a new value network or works in an industry that is highly volatile, emergent exchanges may also be highly important, as these provide opportunities for learning about the industry and its development.

Marketing Analysis and Design. A marketing analysis and design that focuses on consumers could potentially include all kinds of resources and exchanges. However, from a consumer point of view, internal resources are the most important, as these are directly related to the needs and wants of a consumer, while economic resources only are used as means for producing the internal resources. Therefore, a value model for marketing analysis and design should highlight internal resources.

Process Design. For process design, formal exchanges constitute a starting point for identifying the activities needed to realise the interactions of a value network. While the activities for formal exchanges can naturally be structured in processes, this is by definition not possible for informal exchanges. Emergent exchanges do not affect processes as they occur as a result of other exchanges. Thus, a value model for process design should focus on formal exchanges. It should be noted that such a value model is not sufficient for designing processes, since many aspects not present in a value model need to be taken into account, such as logistics and risk management.

Business model development. Business model development is a comprehensive activity that includes profitability analysis, benefit analysis and marketing analysis. In addition, it may also want to capitalize on the competitive capabilities of each actor, as represented by internal knowledge resources.

5 A Remake of the Health Care Scenario

Figure 3 show a remake of the running case taking into consideration the analysis of resources and exchanges from the previous section. Due to space limitations, we have here opted to keep as many of the constructs from the model of figure 2 as we could. The alternative was to make several models each according to one modeling purpose, e.g., profitability analysis or process design. We use the following notational conventions in the model:

- Economic resources are shown as full lines as usual.
- Internal resources are shown as dash-dotted lines.

- Joint resources are shown as dotted lines.
- Formal exchanges are shown as blue lines.
- Informal exchanges are shown as green lines.
- Emergent exchanges are shown as red lines.

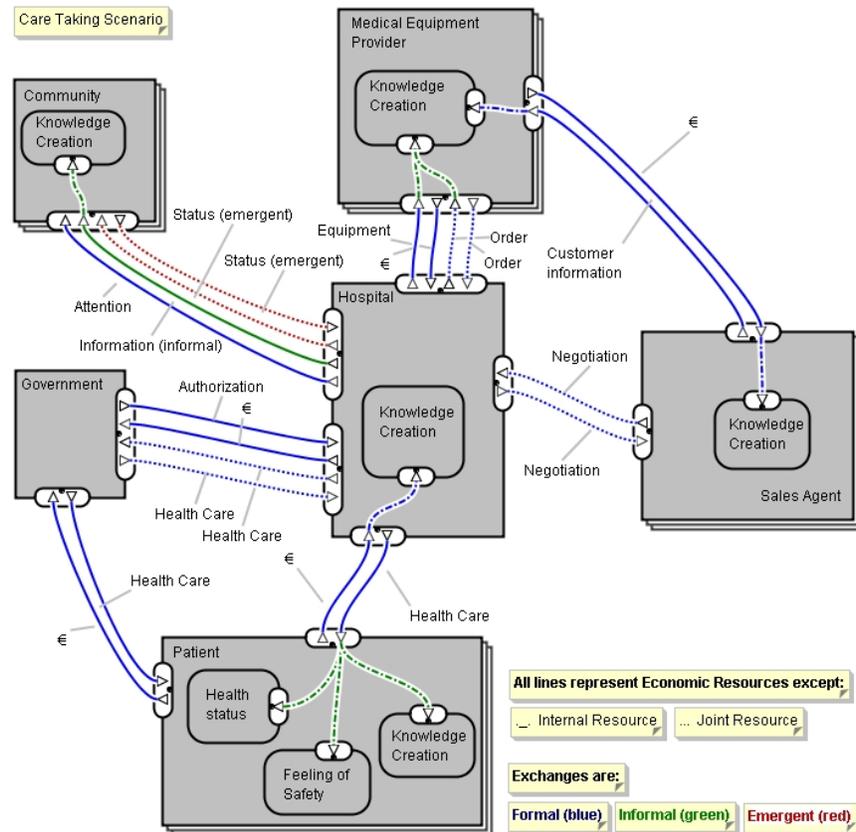


Fig. 3. Elaborated value model for the Care Taking Scenario

Comments on the elaborated value model

Medical Equipment Provider - Hospital. We consider the knowledge exchange to be informal. The provider has an informal requirement of transforming information gained from hospitals into knowledge. This is indicated in figure 3 by showing that the internal resource knowledge is produced from the resource inputs money and

order. The order is a formal upholding of a relationship; the money is a formal commitment to pay. The equipment is a formal commitment to deliver. Note that the order comes about as a result of first a negotiation between (a) the hospital and the sales agent, and (b) the customer information exchange between the sales agent and the equipment provider.

Sales agent - Hospital. The negotiation is a joint resource owned by both actors. In figure 3 the resource transfer is bidirectional indicating that both actors are upholding the negotiation (due to a limitation in the tool it is drawn as two separate transfers).

Government - Hospital. In order to provide health care to patients, a hospital must be authorized. The authorization is provided by the government for a fee. The resource provided by the hospital to the government is health care. Of course, it is not the health of the government that is at stake but that of the citizens. The government regulates the hospitals and the hospitals provide care for the citizens according to the regulations. Care taking would not take place without this agreement. All exchanges between government and hospital are considered formal.

Government - Patient. A patient pays tax to the government. In return the patient gets an insurance statement stating that if the patient gets ill, he has a right to be treated by an authorized care taker. The government as such does not provide health care, of course. That is what hospitals do.

Patient - Hospital. The only economic exchange taking place is money for health care. There is an informal exchange of a feeling of safety and this feeling is a resource internal to the patient. One can argue, as in figure 3, that this resource stems from knowing that the patient is treated at a good hospital. The internal health status is analogous to the feeling of safety. There is a knowledge exchange in both directions; the hospital learns from treating the patient and has a formal procedure for doing so. The patient learns by being informed by the hospital. This internal resource is probably not acquired formally but rather informally.

Hospital - Community. The hospital joins a care taking community in order to get higher status as a care giver. Conversely, the community gains in status if the hospital has a high status. One thing that the hospital provides to the community is information that is converted into knowledge. No economic gain comes directly to the hospital from sharing information with the community. The economic gain for the hospital lies elsewhere in other exchanges; for example, it might become easier to get authorization by the government if membership in the community can be shown.

Sales agent - Medical Equipment Provider. The sales agent receives funds for delivering customer information which has been gathered through negotiations. This information is subsequently turned into an order which is a joint resource between the sales agent and the provider. Note that we did not include any notion of physical transfer of goods in the models. The transfer of equipment from provider to hospital refers to the transfer of rights on the equipment.

6 Concluding Remarks

The problem addressed in this paper was the complexity of value models that may result in large and unfocused models that are not adequately guided by their purpose. In order to overcome this problem, we proposed guidelines based on classifications of resources and resource exchanges. The classification of resources was based on the degree to which a resource is tied to an actor, resulting in three classes of resources: economic resources, internal resources, and joint resources. The classification of resource exchanges was based on the degree of their formality and intentionality, resulting in three classes: formal exchanges, informal exchanges, and emergent exchanges.

We claimed that the design of value models should be guided by their purpose and identified an initial set of purposes. We then outlined a number of guidelines for each purpose using the proposed classifications of resources and resource exchanges.

We also introduced suggestions for graphical notations, close to the e3value diagrams, that distinguish between different kinds of resources and resource exchanges. A topic for further work is to improve and explore alternatives to these notations. Another topic for further research is to empirically test the approach with respect to usability. A more fundamental issue is to investigate alternative classifications of resources and resource exchanges and their applicability for guiding the design of value models.

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