

REA Value Chain versus Supply Chain

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Abstract: The aim of the paper is to find out how the value models of individual enterprises should be linked and utilized together. A value model is an abstraction for accounting purposes and is used for individual enterprise modeling. REA value chain replaces value activities in the value model by REA value models (business processes). A supply chain concept is an abstraction for logistics and trade purposes and is utilized for linking individual enterprises to create single entity. The paper focuses on finding common properties between supply chain and value chain, especially REA value chain and possibilities of utilizing REA ontology in linking individual enterprises together.

Keywords: value modeling business ontology, REA ontology, value chain, supply chain

1. Introduction

Object of our interest is the REA ontology, because it links together business process modeling with the underlying economic phenomena. REA ontology benefits from the presence of a semantic and application independent data model, an object oriented perspective, and abstraction from technical and implementation details. In addition to other aspects, it offers full traceability of all activities that influence the value of the enterprise's resources. This enables the possibility to calculate the value of the enterprise's resources on demand. Furthermore, the REA ontology contains rules for formulating well-formed models of enterprise processes. The goal of economic agent's processes is to increase the value of its economic resources. All well formed REA models obey a fundamental rule, that there is no increase of the resource value for free, that is, every increase of a resource value is for an economic agent always paired with some decrease of the value of some of its resources. This fundamental feature of every REA model is that it answers the question why an enterprise performs a given activity, that is, why the economic events occur.

2. REA Enterprise Ontology

By (Geerts, McCarthy 2000) the REA ontology is described as a three-level architecture consisting of the *REA value chain*, *REA value model* and *Task level specification*. However, in some publications e.g. (Dunn et al. 2004) the REA

ontology is presented as a four level architecture, see Fig. 1. The fourth level creates the most upper level that is called *REA value system*. This level focuses on the resources that are exchanged between the enterprise and its various external business partners such as suppliers, creditors/investors, customers, and employees. A supply chain is made up of the value-system level models of interconnected business partners, by (Dunn et al. 2004).

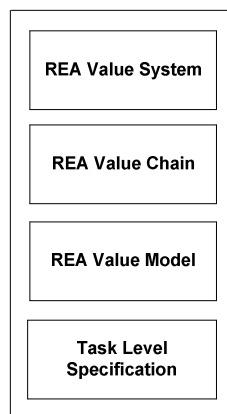


Fig. 1 REA four-level architecture Source: [Dunn et al. 2004]

The *REA value chain level* focuses on the resource flows between interconnected business processes and on the economic events that accomplish the resource flows. The *REA value model level* represents a business process level and focuses on one or more transaction cycles in the enterprise's value chain. A *task level* addresses itself to the individual steps involved in accomplishing events in an enterprise. Tasks are activities that may be changed or eliminated and therefore should not serve as foundational elements in enterprise information systems.

2.1 REA Value System

REA value system clearly identifies external business partners and the resources that are exchanged among them. Fig. 2 describes typical REA value system in an enterprise. As can be seen from the figure, external business partners for the company are: *Investors* and *Creditors*, *Suppliers (Vendors)*, *Employees* and *Customers*. There are resources such as *cash*, *goods* and *services*, *labor* that are exchanged between the enterprise and its business partners. This model level illustrates only exchange processes. Conversion processes remain hidden inside the company. Between the enterprise and each of its business partners there are two ways of resource flows, inside and outside modeled concepts, in the same way as in supply chain.

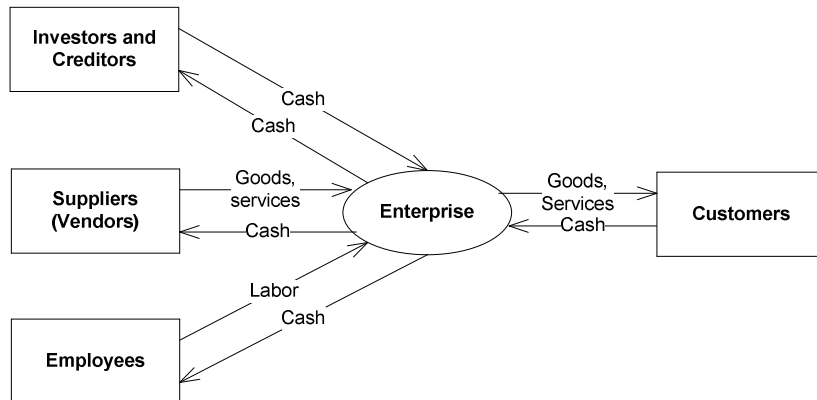


Fig. 2 REA value system

Source: [Dunn et al. 2004]

2.2 REA Value Chain Model

A REA value chain model focuses on the resource flows between interconnected business processes and on the economic events that accomplish the resource flow. It originated in a value chain concept developed and introduced by Michael Porter (Porter 1980). A fundamental notion in value chain analysis is that a product gains value as it passes through a stream of production within the chain in an enterprise.

REA value chain is a network of business processes whose purpose is to directly or indirectly contribute to the creation of the desired features of the final product or service, and to exchange it with other economic agents for a resource that has a greater value for the enterprise (Geerts, McCarthy 1997). While the business processes are in the REA ontology stick together by the *duality relationships* (see chapter 2.3), the value chain models are weaved by resource inflow and outflow relationships. Fig. 3 shows resource value flows in the REA value chain model. The REA value chain provides overall view of the modeling domain. It can be also used for consistency checking. The REA value system depicted in Fig. 2, is transformed into REA value chain, illustrated in Fig. 3, in the following way:

- *Financing Process* expresses relation between *Investors and Creditors* and the *Enterprise*.
- *Purchase Process* describes relation between *Suppliers (Vendors)* and *Enterprise*.
- *Payroll Process* represents relation between *Employees and the Company*.
- *Sales Process* illustrates relation between the *Enterprise and Customers*.
- *Production Process* is a conversion process inside the company.

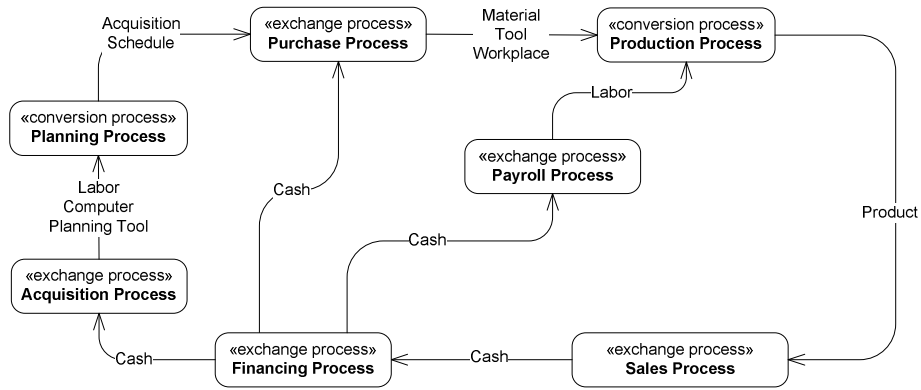


Fig. 3 Extended REA value chain model Source: [Authors]

REA value chain model also describes *Planning process* that is closely connected with Acquisition process. The aim of the Planning process is to create Acquisition schedule that precisely specifies the needs of the Purchase process, which ensures material, tool and workplace for ensuing Production process. Acquisition process is needed for arranging skilful labor, computer and planning tool, which are necessary resources for the Planning process.

2.3 REA Value Model

The REA value model represents a model of a business process and creates a fundamental view provided by the REA ontology.

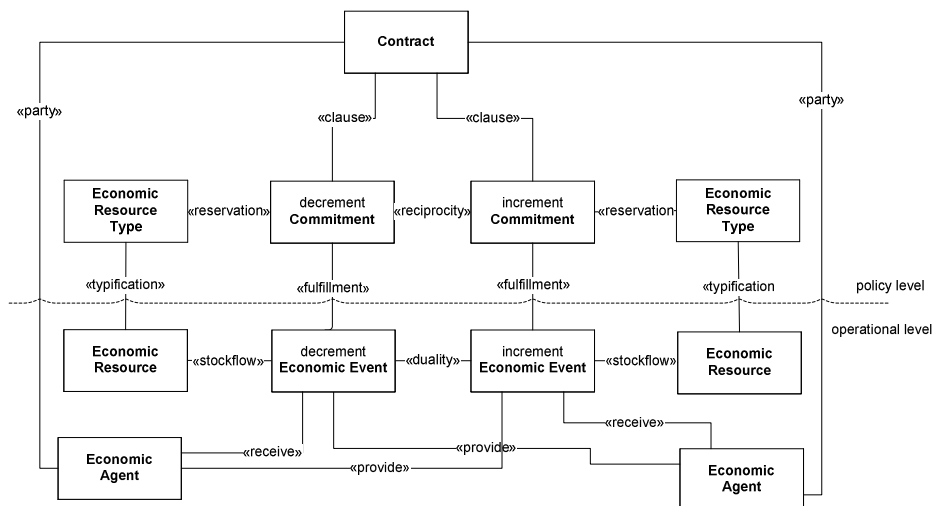


Fig. 4 REA value model – exchange process Source: [Hruby 2006]

Fig. 4 illustrates general exchange process that corresponds to one of the *exchange processes* in Fig. 3.

3. Supply Chain

Supply chain is the entire network of enterprises (e.g., retailers, wholesalers and transportation firms) involved in providing a particular product or service to an end customer by (Dunn et al. 2004). Supply chain activities transform natural resources, raw materials and components into a finished product that is delivered to the end customer. Supply Chain Management (SCM) emerged in the 1980s as a new integrative philosophy to manage the total flow of goods from suppliers to the ultimate user (Cooper et al. 1997). The essence of this approach was the management of a chain of supply as though it was a single entity with the primary objective of fixing the suboptimal deployment of inventory and capacity (Laseter, Oliver, 2003).

The value chain, also known as value chain analysis, is a concept from business management that was first described and popularized by Michael Porter. It is a chain of activities for an enterprise operating in a specific industry. That is why it is said that supply chains link value chains. Porter's value chain is a tool and conceptual framework for examining and diagnosing the competitive advantage of a company. Although very useful as a modeling technique for business systems, the original purpose of Porter's value chain was not to design software business applications. This concept divides processes of the enterprise into *core business processes* that add value to the end products of the enterprise, and *support processes* that enable the core processes and add value indirectly. In fact, every process adds value (otherwise a rational enterprise would not have it), and the result of analysis should be a complete model expressing how every process contributes to the complete chain.

4. REA Value Chain versus Supply Chain

In general, a supply chain and a value chain are complementary views of the extended enterprise with integrated business processes enabling the flows of products and services in one direction, and of value as represented by demand and cash flow in the other (Clemmer 1990). The REA ontology in its essence follows the resource value flows. There is no explicit general distinction between these individual directions. Each REA value model distinguishes outflow and inflow of resource values.

REA value system, as it is illustrated in Fig. 2, is still delineated for one enterprise only. However, the main purpose of the supply chain model is to cover all enterprises and their business partners that participate in the final product production. Fig. 5 shows possible connection of two enterprises in the REA value system model.

As can be seen in Fig. 5, the diagram can also contain other enterprises in a similar way. We suppose for simplicity that each enterprise would require the same structure of their business partners. During transformation of the *REA value system* into *REA value chain*, we encountered a challenge of dependent and independent views that have their origin in REA value model and are also showed in REA value chain.

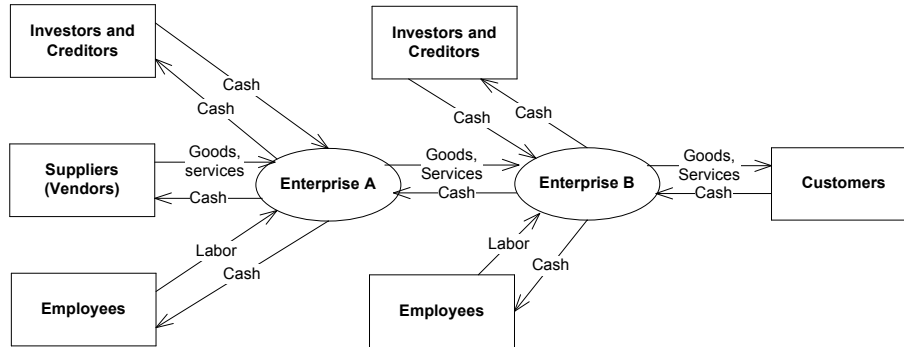


Fig. 5 REA value system for two enterprises Source: [Authors]

REA value model traditionally represents the given agent side of view. Actually, by the view it is distinguished whether the economic event is either incremental or decremental. In case, the application model also covers planning (policy level) it is necessary to take into account also commitments and to set proper meaning for incremental and decremental commitment. In this way the same economic events have a different meaning.

However, it is possible, in contrast to the trading partner models, to create the model from the perspective of an independent view. This independent observer is illustrated in Fig. 6. Note that in the independent view, the concepts of increment and decrement do not exist, economic events represent transfer. Likewise, relationships of inflow and outflow do not exist, and are represented by stockflow relationships. For simplicity, Fig. 6 depicts only operational level of the REA value model. Above mentioned solution may typically represent *purchase/sales exchange process*. For one agent it is purchase process while for another it is sales process. This situation will happen when REA value chains of different REA value systems are connected together, see Fig. 7. In this case, an exchange process (purchase/sales) must be modeled utilizing an independent view.

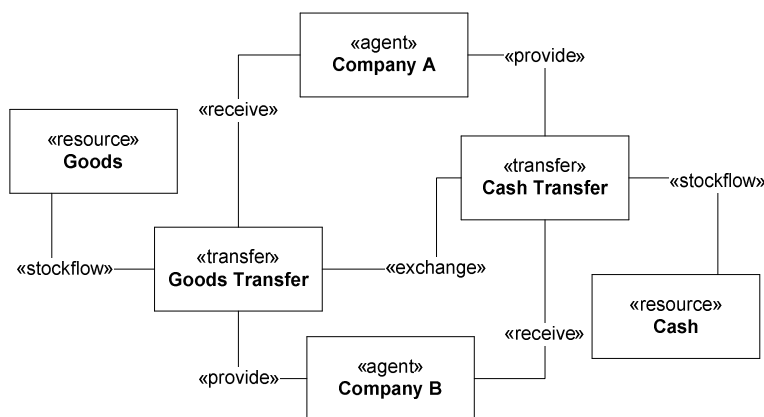


Fig. 6 REA value model – independent view Source: [Hruby, 2006]

The first conclusion for applying REA ontology in supply chain is utilizing independent view in the bordering of the exchange processes. By border we mean boundary of the individual REA value systems.

The next challenge concerns the core idea of the value chain concept designed by (Porter 1980). The value chain concept distinguishes between processes that add value to the final products and those that do not (supportive processes). On the other hand, REA value model can describes both of these processes. The issue is how to model supportive processes in the REA value chain concept.

Some research in this area was performed (Weigand et.al 2010, Hunka et al. 2010) but there is still some work to be done to completely finish this challenge and prepare for utilization. Fig. 7 illustrates the extended REA value chain model of an individual enterprise that proposes possible solution. It is supposed that purchase/sales process in the right hand side of the figure can be used for connection to another REA value chain.

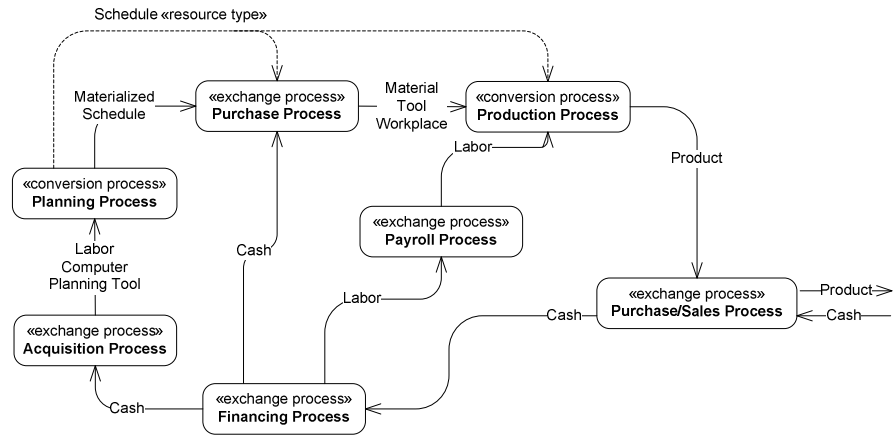


Fig. 7 Extended REA value chain for one enterprise Source: [Authors]

The REA planning process outputs not only a resource but also a resource type. Solid lines with arrows at their ends represent the aim of flows of resources. The *Materialized Schedule* resource represents a resource flow that expresses a real cost of the *Schedule* resource type. The dashed line, marked as *Schedule* resource type represents the flow of a resource type. This resource type is supposed to be super-type of the schedule and the outputted resource type is down cast to the schedule entity in the purchase and production processes.

5. Conclusions

The essence of supply chain is managing the whole chain as it was a single entity. If there is a need to model supply chain utilizing REA value chain, the resulting model should prove this feature too. However, REA value chain that plays crucial role in this modeling was not designed to model supportive processes that inevitably belong to

the whole chain. The paper proposes extended REA value chain to overcome the challenge of supportive processes.

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