

A value network model for strategic analysis

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Abstract

This paper describes a new framework for modeling value network of inter-organization interactions. We propose a set of building blocks elements of the model made of economic entities and offering transfers and describe a methodology that configures a business or organization network based on maximizing the consumption of the common value proposition.

1. Introduction

As the economy is becoming more connected, more global, and more complex, strategic tools are required to provide insight to researchers and practitioners trying to analyze firm's interactions. Indeed, as the result of the shift among industries, firm relationships have increased in complexity. Firms can no longer be classified neatly as customers, suppliers or competitors. Often they are two or more of these dimensions simultaneously [3]. In the banking example, a traditional retail bank might partner with Intuit to provide a feed into the Quicken software package, while Intuit competes directly with the bank in checking services. A dynamic approach to inter-organizational exchange is needed to capture the nuances of these complex relationships between firms.

Also, advances in technology have contributed to an increase in the number of inter-organizational relationships and the complexity of these relationships. The internet and high bandwidth connectivity make it possible for firms to engage in intricate transactions with fewer spatial and temporal constraints. In addition, web services have automated many of labor intensive elements of inter-organizational exchanges, thus reducing the costs and complexity of these relationships [13].

Researchers have considered exchanges and interactions as determining factors in organization and strategy as can be seen through work on Transaction

Costs Economics [5], [22]. In addition, from the resource-based theory of the firm [2], the need for scarce resources is a reason for firms to enter into exchange relationships and the strategic use of relationships is recommended to gain competitive advantage [7].

In the past, the Porter's value chain model [18] has provided a macro view of firms' exchanges analysis by considering the flow of goods and services from raw materials to consumption as unit of analysis. While these seminal works and their associated streams of research continue to provide insight and contribution to our understanding of inter-organizational relationships, today's dynamic and complex environment requires a higher level, network view of inter-organizational exchanges at both the conceptual and practical level.

Value Network as a model of inter-organizational exchanges is an attempt to address the increasing intricateness of inter-firm relationships, pushed by a more and more connected economy. Value Network has long been an object of interest for both researchers and practitioners [1], [3], [15], [16]. However, the term usually denotes conflicting views and proposed studies lack rigorous models that could allow for descriptive and prescriptive analysis.

We propose a more concrete and rigorous value network model for identifying and analyzing inter-organization exchanges, by synthesizing and extending previous work in the area, in particular the e3-value model [8], the c3-value [23], and the Allee's model of intangibles.

2. A Review of Value Network Concepts and Models

A wide variety of theoretical perspectives have been used to study inter-organizational exchanges and networks. From resource and capability-based

perspectives ([14], [19], [6]) to social networking [21] and structural holes [4], and transaction cost perspectives ([5], [22]). Most of the research on inter-organizational relationships has focused on the precursors to alliance and network formation at the concept level; the work tends to be descriptive rather than prescriptive. A broad survey of this body of work is outside the scope of this paper. However, we will examine the research that has explored the drivers of inter-organizational, especially network-based.

One of the early works in the network-view of economy is provided by the Industrial Network perspective [12]. The Industrial Network perspective views the industrial market as a complex networks of inter-organization relationships, position and processes [9], specifically tying firm performance to their position in the network [4]. The Actor, Resources, and Activities model in industrial networks (ARA model) [12] builds upon this view and outlines a conceptual model for analyzing firm's interactions. Actors, such as companies, firms, or individuals, perform activities using a set of resources. The model proposes a tripartite linkage where Actors are connected by bonds, Activities by links, and Resources by ties. The ARA model assumes the unmanageability of the network: Networks represent industry dynamics and hence by definition are neither controllable nor manageable.

In contrast, Gulati [10] asserts that networks are manageable. He provides a rich overview of the literature regarding the use of organizational alliances as deliberate strategic moves. The term 'strategic network' has been used for such a network and seen as a new type of governance positioned in the middle ground between market and hierarchy [20]. Gulati identifies several "formulas of strategic success" including flexibility in management, trust, patterns of information exchange, and conflict management.

A line of researchers ([1],[16]) have proposed more concrete concepts of the *value network* with detailed taxonomies of what is being exchanged [1] or how activities are distributed [16]. Allee [1] driving from the knowledge view of the firm, sees a Value Network as '*a complex sets of social and technical resources that work together via relationships to create economic value in the form of knowledge, intelligence, a product (business), services or social good*'. Allee's Value Network is particularly geared toward expressing intangible exchanges and seemed less inclined to allow for strategic analysis insight.

Parolini [16], extending the value constellation concept of Normann and Ramirez [15] conceptualizes

Value Network as "*a set of activities linked together to deliver a value proposition at the end consumer*". Parolini's core entities are the activities within the network. The Value Network has a *purpose*, which is satisfying the value proposition at the end consumer. This purpose also implicitly sets the boundaries of the network. This is a strategic view of the network that allows for a more prescriptive model.

Our proposed model also uses a tripartite view of the value network, but with a different set of views than the ones presented by the ARA model. Also, like Gulati [10], we assume the manageability of the network, and like Parolini [16], the existence of an end consumer.

3. Modeling Approaches to Value Network

Various approaches have been proposed to create a modeling language for firm interactions. Our literature survey identifies the following models as interesting attempts to represent inter-organization exchanges: the i-framework [25], the e3-value modeling framework [8], the c3-value modeling framework [28], and the Allee's modeling framework [1]. Our focus is on the e3-value, c3-value model, and Allee's model, since these models are the most closely related to our proposed approach.

3.1 e3-value modeling

e3-value modeling approach is a conceptual representation that has its basis in the ARA model view of the industry. The e3-value network [8] assumes the following core entities.

An Actor is an economically independent entity representing a company, an organization, or a customer. It is not necessarily a legal entity. A *Value object* is what is being exchanged between actors with the exchange done through a *Value Port*, which is a connection point between the Actor and the outside world. The value object could be a service, good or money that has an economic value to at least one the Actor.

A value exchanged connects to a Value port and represents a pipe through which a value object could be potentially traded. *A value interface* is a group of value ports. *A value activity* is performed by an actor motivated by a potential profit. *A Market Segment* is a clustering of actors that assign economic value to object equally, and is typically used to model an group end-consumer with similar interest.

The e3-value model is an efficient modeling framework that has been used in wide array of modeling engagements [8]. However, unlike our proposed approach, the lack of a clear strategic focus in the model weakens its ability for prescriptive strategic insights.

3.2. c3-value model

The c3-value modeling scheme [23] is an extension of the e3-value model geared toward strategic analysis. Starting from the resource-based view of the firm (RBV), with its claim that sustained competitive advantage is gained by owning strategic resources that are valuable, rare, inimitable, and non-substitutable (VRIN) [2], the c3-value modeling approach proposes analyzing strategy along the following three dimensions: customer, capabilities, and competition, with a particular emphasis on competition as a means to realize the VRIN characteristics.

Indeed the c3-model explicitly takes into account the value proposition that is conveyed by the e3-value's value objects and proposes a dichotomy of the transferred value: a primary value object that conveys the intended businesses of an actor and the secondary value object that enhances the value delivered by the primary value object.

The c3-value modeling approach is a powerful strategic technique. However, while our proposed approach focuses on the network to gain a competitive edge, the c3-value framework focuses on the direct competitor and the direct customer thus neglecting the inter-dependencies inherent in the current global economy and the potential given by the network perspective.

3.3. The Allee's model

Allee's considers a value network as an autopoietic or living system, a system that continually changes and reproduces itself [1]. As such the network is unmanageable. Allee's model is constituted by the following entities: *participants, transactions, deliverables, and exchanges*.

A participant represents an individual or group of people (organization, business units, communities, etc). Transactions refer to a transfer of a deliverable from one participant to another. In Allee's model transaction are unidirectional and a bi-directional transaction is called an exchange, which is a transaction that triggers a response from the recipient to the original sender.

Exchanges are of primary importance in the model as drivers of value. Deliverables can be tangible such as good, services, and revenue, or intangible such as knowledge and benefit.

Analysis within the Allee's framework is mostly visual and consists of detecting *patterns of exchanges* between participants, specially the ones involving intangibles, with the assumption that value is created through exchanges. Our proposed approach is geared towards strategic analysis with the assumption of an end-consumer as the main valuator of the whole network. Unlike our proposed model, Verna's model does not assign a purpose to the network and its focus on exchanges added to its assumption on the unmanageability of the network limits its potential for strategic analysis.

4. Network-based Value Modeling

This section proposes key elements that could be used as basic language for descriptive and prescriptive strategic analysis with emphasis on the potential generated by the network.

We view the value network as a set of *economic entities* (EE) connected through *transfer of offerings* that yields a structural network whose purpose is to deliver a *common value proposition* to a specified *end-consumer or market*. It is a structure where value is created, recognized, and captured. The common value proposition is targeted towards a specific economic entity whose role is to appreciate, evaluate, and consume the value proposition.

We take the Parolini's approach [16] by focusing on the end consumer but consider economic entities are the primary building blocks of the model. The focus on the end consumer automatically sets the boundaries of the analysis and a clear path for prescriptive analysis. The focus on economic entities gives a clear granularity in the unit of analysis.

4.1. Economic entity

An economic entity is defined in legal terms as an entity whose activities are clearly separated from the activities of its owner. It is an accounting term destined to clearly identify financial responsibilities and accountabilities. We adopt this definition albeit extending it to include any economic agents with a transferable where the transfer process can be monitored and acknowledged by a third party. As such, an R&D department within a firm will not qualify as an economic entity (legally speaking) but can

nevertheless be modeled in our framework since its output (patents, prototypes) could clearly be identified by a third party. Thus, in our model, economic entities may be firms, business units, or individuals.

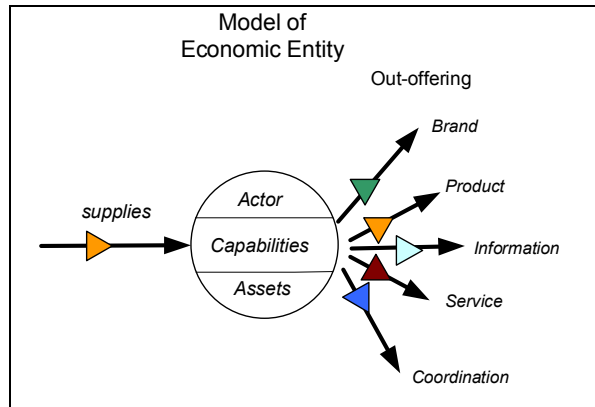


Figure 1: The model of an economic entity for value network analysis. An economic entity can be viewed through three perspectives: actor, capabilities, and assets. The economic entity creates value by transforming in-offerings (supplies) into out-offerings. An out-offering can be a product, service, information, brand, and coordination.

The model of an economic entity is illustrated in Figure 1. In a manner similar to the tripartite ARA model [12], the economic entity can be viewed through three perspectives: the actor perspective, the capability perspective, and the asset perspective. The actor represents the legal entity endowed with a will, business intent, and a valuation function that appreciates and values the economic landscape and takes decision accordingly. In this respect, economic entities are not dissimilar to Actors in the e3/c3-value framework.

The capability perspective describes the set of activities, processes, and dynamics that are specific to the economic entity; they are an aggregate result of the ability of the economic entity to deliver and differentiate itself from the competition [11].

The asset perspective describes the material, technology, capital, and knowledge, possessed by the economic entity. They are the (tangible and intangible) *static* resources that are tied permanently or semi-permanently to the firm [24]. Assets are the ‘energy’ that enables the ‘capabilities’ machinery to function. From the resource-based view of the firm, sustained competitive advantage is achieved by an accurate bundling of capabilities and assets to achieve uniqueness and inimitability in offerings [2], [24].

4.2. Offering

Offerings refer to any transferable from one economic entity to another [15]. The transferable could be a manufactured product, a service, knowledge or brand. Offerings are transferred through unidirectional *links*. Transfer of offerings does not necessarily include a transaction.

As shown in Figure 1, offerings are transferred in and out. In-offerings are referred to as *supplies* and are transformed into specific out-offerings by the actor using capabilities and assets. Supplies necessarily have corresponding out-offerings, and the transformation of supplies into out-offerings is what creates value. At the receiving end, the recipient appreciates the received offerings and measures their value through its valuation function.

Out-offerings are of five types: *product, services, brand, information, and coordination*. A product is any transferable out where the ownership of the transferable is also transferred to the recipient.

A service is an out-offering whose corresponding supply is given by the recipient. Indeed, a patient brings his body along to be treated by the doctor and or the homeowner bring along the broken pipe of his house to be fixed by the plumber. A service necessarily implies an exchange between a services provider and the customer in which the services transforms the *state* of the supplies provided by its client.

A brand is a prior awareness of the potential value generated by the economic entity, typically as a consequence of past offerings appreciation or a deliberate marketable intangible as exemplified by the company Nike.

Coordination is a network-centric offering typically absent from most strategic analysis but deemed prominent in the network-based perspective. Coordination creates value by managing the network of economics entities and their offerings. The typical example is the Chinese company Li and Fung. Li and Fung is a known provider of garment. However, its core business is primarily managing the supply chain of garment manufacturers that connects various businesses together. Li and Fung does not manufacture any garment.

4.3 Financials

Financials are flow of revenue between economic entities. They may or may not be tied to the transfer of offerings.

4.4. An end consumer

An end consumer is a special node in the network. It is the "sink" whose role is to consume and appreciate the value proposition of the overall network. Similar to the e3-value model, the end consumer represents either aggregated customers or a market segment, meaning that the end-consumer is not necessarily an economic entity. The end consumer is endowed with a valuation function, for evaluating and appreciating the whole network's value proposition.

4.5. A value proposition

A value proposition is a clear statement of the benefits that the end consumer gets from using the products or services the network provides. It could represent the aggregated business intent of all nodes in the network (descriptive approach) or the realization of a node's business intent through the network (prescriptive approach). Traditionally, the value proposition is supposed to capture the relationships between the suppliers' offerings and immediate customer's needs [16]. Our view of value propositions contrasts with this traditional view in that a value proposition is targeted at end consumers but not at intermediate supply chain partners. This does not mean that the direct customer is neglected. He is simply viewed as a means to the end goal of realizing the value proposition at the final consuming point. The general question then is how to measure and quantify a value proposition. A value proposition is contextual, dependent on the type of business and the targeted market and can take various forms such as in-time services, convenience, or personalization.

It is not an intention of this paper to propose a taxonomy or metrics for quantifying a value proposition. Instead, within a prescriptive approach, we assume that the value proposition is predefined and the network is designed accordingly.

5. Value Network Analysis

The above model provides a blueprint for the strategist and the practitioner in analyzing and configuring the network for potential gain. We propose the following two principles in designing a network-based strategy:

Principle 1: *Value creation and transfer of offerings are targeted toward optimizing the value proposition at the end-consumer node not to immediate customers (first-tier customers)*

Traditional strategic modeling approaches focus on the fulfillment of the immediate customer needs. The goal of the proposed VNA approach is not to make fast delivery from warehouses to retailers but to target the end buyers of finished products or services. This principle affirms that the health of the network dependent on the appreciation of the overall value proposition at the consuming point; the whole network is being considered for identifying strategic moves.

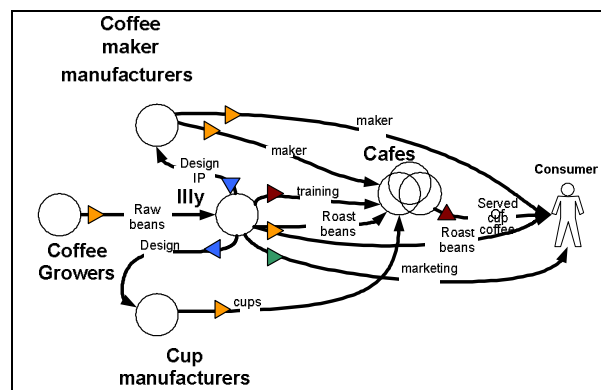


Figure 2: Illycaffè's value network. The company has generated offerings transfer to coffee machine makers, cup manufacturers, and cafés in order to 'provide an excellent cup of coffee' to the end consumer [16].

It has been observed that companies that apply this principle are successful in their respective industry. The typical example is Illycaffè, an Italian coffee bean roasting company. The company's value network is illustrated in Figure 2. The company's value proposition is to provide the end consumer with 'an excellent cup of coffee'. In order to do this, the company has provided design of coffee making machines to coffee machine manufacturers, free of charge. In addition, the company has provided training in coffee making to barmen, again free of charge, and provided cup design to cup manufacturers, also free of charge. Illycaffè has doubled its sales from 1993 to 1997 and increased market share in the tight market of upper brand hotels, restaurant, and cafés, despite the fact that Illycaffè's products cost twice as much as their competitors! See [16] for more details.

Also, from the analysis viewpoint, focusing on the end consumer provides the boundaries of the analysis. Indeed, a question left uncommented is about the limit

of the network. Theoretically, the network would include the whole economy. Targeting the value provided to the end-consumer limits the scope of analysis to those firms that have a clear impact on that value.

At the network level, financial gain is realized by taking the whole network into account. Seeing the network as a partner where various offerings could be transferred. This enhances potential gain by enabling the focal company to diversify each offering according to the taxonomies given by the model presented here. Indeed coordination is a network-centric offering that could provide key differentiation in a stiff competitive environment.

Principle 2: *The flow of offerings and flow of financials are separated.*

The model assumes that financial revenue is *not* solely generated through transactions but by a *strategic use of the whole network*. This is in contrast to previous model. Revenue generation could or could not be transaction-based and giving offering "away" is a valid network-based strategy. This is a different view of transaction based economic, which differs from the usual thinking in transaction-cost economics [22]. This principle is validated by an acute observation of the marketing behavior in the current economic landscape with examples such as open-source-based businesses or web-based advertisement businesses.

5.1. Descriptive Analysis

The relation between supplies and out-offerings is *causality* whereas the relation between two out-offerings or two in-offerings is a *correlation*. The network also creates a remote correlation between offerings belonging to different economic entities. The role of descriptive value network analysis is to estimate these correlations and causality using available data about variables describing offerings (sales, volumes, type of relationships, etc), actors (willingness, intentions, etc), capabilities (level of skills, type of expertise, etc), assets (available capital, time constraints, book values, etc) of each entity in the network. To do this, the basic model of an economic entity could be transformed into a dependency graph linking the variables that describe offerings, capabilities, assets, and actors. Clearly, supplies, assets, and capabilities precede and cause offerings. Supplies affect the current *state* of capabilities and increases or decreases assets. The graph creates the foundation on how impact analysis should be pursued. For instance, the causal graph can be used to identify

dependent and independent variables for regression analysis or be transformed into a Directed Acyclical Graphical model such as Bayesian Belief Network, or a system dynamics model.

5.2. Prescriptive Analysis

Having introduced the framework, we describe the methodology of strategic analysis involving the following steps:

(1) Define a strategic value proposition and understand its focus (e.g. quality, cost, or both).

(2) Specify the offerings each partner in the network can provide and evaluate the impact of each offering on the value proposition (for example in terms of quality and cost). This evaluation could be done in a binary fashion in the form of impacting versus not impacting the value proposition. More sophisticated measuring methods, like ranking offerings, could also be taken.

(3) Select proper partners based on the evaluation of offerings and determine the links that transfer the offerings. The strategy now is to create transfer links for those offerings which have impact on the value proposition. Note that Steps (3)-(4) may be iterated for several times to achieve a balanced picture of offerings. The focal node can add new offerings in the form of services or information and transfer them to selected nodes, based on the dual impact of the focal node's offerings and the targeted nodes' offerings on the value proposition.

(4) Add value and cost to each offering and analyze the VNA model theoretically or by simulation. In general, a qualitative configuration provided through Steps (1)-(4) is sufficient. When data is available, theoretical analyses can be performed using Petri-net, system dynamics, or statistical models as suggested in section 5.1. For example, maximize the profit in the supply chain while delivering value to the end consumer as expected. Based on the analysis, new offering may be added or existing offerings may be modified or deleted.

(4) Steps (3)-(5) may be repeated several times until a satisfactory model is achieved.

Whereas traditional value chain analysis usually considers only the horizontal elements across the supply chain, value networks consider vertical elements such as complementors, competitors, influencers and strategic alliances partners. Central to

the notion of value networks is the end consumer or market value proposition. The value network can now be seen set of capabilities and assets available to all network participants, and the role of the strategist is to find the proper bundling of assets and capabilities by creation of transfer links in order to maximize the its value proposition at the end consumer node. Every node within a value network is analyzed based on its contribution to that central value propositions. Thus, a value network analysis involves a firm's understanding of how its offering is positioned in terms of the final customer value, and how other nodes effect that final proposition.

6. Conclusion

We have described building block elements of a value network model that sets the foundation for a descriptive and prescriptive analysis of firm's interactions. The proposed model extends previous work in the area but is distinguished by its focus on the whole network and its use of the network to achieve competitive advantage. Our next steps are to validate the proposed approach through real case studies.

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7. References

[1] Allee, V., *The Future of Knowledge: Increasing Prosperity through Value Networks*, Boston: Butterworth-Heinemann, 2002

[2] Barney J.B., "Firm resources and sustained competitive advantage", *Journal of Management*, 17, 1991, 99-120.

[3] Brandenburg A. and Nalebuff B., J., *Co-opetition: A Revolution Mindset That Combines Competition and Cooperation : The Game Theory Strategy That's Changing the Game of Business*, Doubleday Book, NY, 1997

[4] Burt, R., *Structural Holes: The Social Structure of Competition*, Harvard university press, paper back edition, 1995.

[5] Coase, R., "The nature of the firm", *Economica*, 4, 1937

[6] Das, T.K. and Tseng, B., "A Resource-Based Theory of Strategic Alliances", *Journal of Management*, Vol. 26, No. 1, 2000, 31-61

[7] Dyer, J.H. and Singh, H., "The relational view: cooperative strategy and sources of interorganizational competitive advantage", *Academy of Management Review*, 23(4), 1998, 660-679.

[8] Gordijn, J., Akkermans J.M. and Vliet J.C. Van, "Business Modeling is not Process Modeling", In *Conceptual Modeling for E-Business and the Web*, LNCS 1921, Springer-Verlag, 2000.40-51

[9] Easton, G., "Industrial Network: A Review" In *Industrial Networks: A New View of Reality*, Axelsson, B. and Easton, G., eds., Routledge, London. pp. 3-34.

[10] Gulati, R., "Alliances and Networks", *Strategic Management Journal* 19, 4, 1998, 293-317

[11] Hamel, G. and Prahalad, *Competing for the future*. Boston, Massachusetts: Harvard Business School Press, 1994

[12] Hakanson and Johanson", "A model of Industrial Network: A Review" , In *Industrial Networks: A New View of Reality*, Axelsson, B., and Easton, G., eds., Routledge, London. 1992, pp. 28-34

[13] Kapoor, S., Bhattacharya, K., Buckley, S., and Chowdhary., P. "A technical framework for sense-and-respond business management. *IBM Systems Journal*, 44, 1, 2005

[14] March, J.G., "Exploration and exploitation in organizational learning. *Organization Sciences*. 2(1) , 1991, 71-87

[15] Normann, R. and Ramirez, R. "From Value Chain to Value Constellation: Designing Interactive Strategy", *Harvard Business Review*, Jul-Aug 1993, pp. 65-77.

[16] Parolini, C., *The Value Net: A Tool for Competitive Strategy*, John Wiley & Sons Ltd, England, 1999.

[17] Pil, F. K. and Holweg, M., "Evolving From Value Chain to Value Grid," *MIT Sloan Management Review* (47:4), 2006, pp. 72-80.

[18] Porter, M., *Competitive Strategy*, Free Press, New York, 1980.

[19] Teece, D.J., Pisano, G., and Shuen, A., "Dynamic Capabilities and Strategic Management", *Strategic Management Journal*, Vol. 18:7, 1997, 509-533

[20] Thorelli H.B., "Networks: Between Markets and Hierarchies", *Strategic Management Journal*, Vol. 7, No. 1 (Jan. - Feb., 1986), pp. 37-5

[21] Uzzi, B., "The Sources and Consequences of Embeddedness and Economic Performance of Organizations: The network effect," *ASR*, 61: 674-698. 1996.

[22] Williamson, O.E. *Markets and hierarchies, analysis and antitrust implications: a study in the economics of internal organization*. New York. Free Press, 1975

[23] Weigand, H., Johannesson, P., Andersson, B., Bergholtz, M., Edirisuriya, A., Llayperuma, T., "Strategic Analysis using Value Modelling - a c3 approach", In *Proceedings of the 40th Hawaii International Conference on System Sciences -2007*.

[24] Wernerfelt, B., "A resource-based view of the firm", *Strategic Management Journal*, 5, 2, 1984, pp 171-180.

[25] Yu, E., "Modelling Strategic Relationships for Process Reengineering". PhD thesis, University of Toronto, Dept. of Computer Science, 1995.