Value Chain Modeling: Linking Customer Value to Business Process Design and Automation

by Fred Cummins

INTRODUCTION

It's been 25 years since Michael Porter introduced value chain analysis in his book *Competitive Advantage: Creating and Sustaining Superior Performance*.[1] The business landscape has changed considerably in that time, but the basic principles Porter introduced have not changed. The goal of value chain analysis is to focus on delivery of value to the customer. The value chain provides a business abstraction focused on capabilities and their relationships to value delivery.

A Porter model typically represents the enterprise as a combination of a half dozen high-level capabilities that lead to customer value. These are broken into more detailed capabilities in a hierarchy often described as a business process hierarchy. eTOM (enhanced Telecom Operations Map)[2] is an example of such a capability breakdown for telecommunications companies. This abstraction does not necessarily align directly with actual business processes nor the management hierarchy. The focus is on *what* the enterprise does or should do to deliver customer value. The business processes and management hierarchy are aspects of *how* the capabilities are managed and coordinated to optimize customer value. Current techniques such as business process management (BPM) and capability mapping do not bridge this gap effectively.

Over the years, enterprises have become more complex. Large corporations have formed from multiple mergers and acquisitions, with varying degrees of consolidation of operations. Corporations and markets have become multinational. Multiple corporations form joint ventures. Enterprises outsource basic business functions and engage networks of suppliers. Lines of business (LOBs) can no longer be operated as independent subsidiaries, but must leverage shared capabilities both across the corporation and with business partners.

Automation has added to this complexity by embedding business processes and dependencies between capabilities into large-scale computer applications. Automation has evolved from improvement of tasks to streamlining cross-functional processes. As the business evolves, the automated systems have become more complex and interdependent, which makes them difficult to adapt to new business models and technological improvements. Technology has also changed relationships with customers and suppliers through high-speed and interactive communications, enabling more extensive outsourcing and creating new customer expectations.

Enterprise managers need computer-based models to manage this complexity. Such models must support appropriate abstractions of the business and at the same time remain aligned with the operation of the business for effective assessment and leadership. Value chain modeling is one such key abstraction. The Object Management Group (OMG) has recently issued an RFP for a Value Delivery Metamodel[3] that will define a computer-based language for modeling value chains.

In this article, I will first outline objectives for a value chain modeling capability. I will then discuss the components of a value chain model, followed by a discussion of the relationship of the model to operational business processes and IT solutions. Finally, I will discuss the potential business benefits of value chain modeling:

- Enhanced customer value
- Improved governance
- Economies of scale
- Focused process improvement
- Agile business adaptation
- Business-IT alignment

MODELING OBJECTIVES

Link Customer Value to Capabilities

The focus of analysis must be on delivery of customer value. Delivery of this value may depend on specific capabilities, a combination of capabilities, or the way capabilities are integrated and coordinated. For

example, timely assessment of an insurance claim may be a key customer value.

Establish Dependencies between Capabilities

Capabilities do not all contribute directly to customer value. Some capabilities depend on other capabilities; for example, a service technician must be deployed before a problem is diagnosed. A model of capabilities and their dependencies provides an abstraction of what capabilities contribute to the end product and a basis for considering capability and process improvements without wading through all of the complexities of business operations.

Simply knowing the capabilities and their contributions is not sufficient for meaningful analysis.

Provide Levels of Abstraction

A complete value chain model may involve many capabilities and dependencies. A diagram depicting all of them may still be too complex for meaningful discussion and analysis. The value chain model should provide relatively high-level abstractions with the ability to selectively expand the detail to understand specific contributions and dependencies. For example, product fabrication might be expanded to show the more detailed phases of fabrication.

Link Capabilities to Responsible Organizations

Capabilities are managed by organizations. These organizations are responsible for effective operations and improvements to their operations. As top managers consider such factors as organizational changes, process improvements, and investment in new technology, they need to understand the organizational context in which these changes must be implemented. For example, a bill of materials explosion is linked to a specifications management organization that maintains the explosion detail.

Support Analysis of Costs, Time to Deliver, and Quality

Simply knowing the capabilities and their contributions is not sufficient for meaningful analysis. In particular, cost, time to deliver, and quality must all be factors in the analysis, as they have cumulative effects on customer value. For example, each activity in a process may capture the cost, delay, and probability of defects per unit of production.

Support Capability Consolidation

In a large enterprise, there will be different value chains for different LOBs. These value chains may engage similar capabilities. The value chain model must support identification of similar capabilities for possible consolidation. For example, skills, machines, facilities, work products, and so on can be compared for similarities.

Identify Opportunities for Process Improvement

Analysis of the value chain model should help identify the need to improve individual capabilities as well as the manner in which business processes engage and operate the capabilities for delivery of customer value. For example, defects might be reduced through redesign of certain tasks or automation.

Optimize Across Multiple Lines of Business

Value chain models for multiple LOBs should support enterprise-level consideration of capability tradeoffs, the impact of capability changes, and investment in new capabilities. For example, consolidation of product distribution may achieve more efficient cargo configuration and transportation routing. Changes to capabilities must be considered in the context of the LOBs they serve.

MODEL COMPONENTS

A value chain modeling environment must integrate a number of components. In this section, I will outline those components and their relationships.

The examples I will cite are primarily based on manufacturing, although the same basic principles apply to other industries. Charles Stabell and Øystein Fjeldstad of the BI Norwegian School of Management describe three different classes of value chain:[4]

1. **Chains** (e.g., manufacturing organizations, where products are mass produced)
2. **Shops** (e.g., job shops, where individual products are developed to customer requirements)
3. **Networks** (e.g., banks, which link savers and borrowers as two classes of customers)

In any enterprise, there are interdependent capabilities that contribute to the creation of value for a customer.

Customer Value Factors

A customer may value price or timeliness, but there may be other factors as well, such as the availability of distinguishing product features, customer services, or the tailoring of a product to particular customer needs.

A modeler must characterize each of the factors that customers value. This should include both those factors for which the enterprise currently achieves customer satisfaction and those that need improvement. For each of these, the capability requirements must be identified.

Core Model

The core value chain model is a dependency network similar to a PERT diagram. Each node in the network depicts an activity that *uses* a capability to contribute to the creation of customer value. Similar to a PERT diagram for a project plan, a dependency (network arc) depicts an activity's need for input that is produced as another activity's output. Typically, analysis will start with the end product and work backward.

Figure 1 depicts a hypothetical value chain for a custom kitchen cabinet supplier. The vendor designs, manufactures, and installs cabinets, including granite countertops. In the diagram, there are three parallel paths for producing customer value: development of the granite counter top, manufacture of the cabinets, and preparation for installation.

The modeling environment should support higher-level abstractions of the value chain network so that a group of activities may be represented by a single, more general activity. Typically these abstractions will associate activities with similar capabilities, particularly those that may require similar resources. This hides some of the complexity to support an overview and the ability to expand into detail as needed. Note, however, that these abstractions may not align to the grouping of capabilities in the management hierarchy, and some capabilities may be outsourced services or part of an external supply chain.

This model has similarities to other business viewpoints. For example, the dependencies in the value chain correspond to material flows in an MRP (manufacturing resource planning) model or to the paper flow in an insurance claims processing service. However, for value chain analysis, the focus is on the uses of capabilities rather than the detail of the business operations and work products.

Inventories

Typically, delivery of each product to a customer does not start with raw materials, but rather draws on component inventories that are purchased or produced in anticipation of customer requests. These inventories are an important factor with respect to time and cost of delivery. Inventories avoid dependency delays, support volume purchasing and transportation, and allow setup costs to be allocated over multiple units of production. On the other hand, inventories add product cost for storage and investment in the cost of the inventories.

Figure 2 depicts the addition of granite and parts inventories (represented by triangles) to the value chain of Figure 1. The time from receipt of a customer order to installation is shortened because the activities between

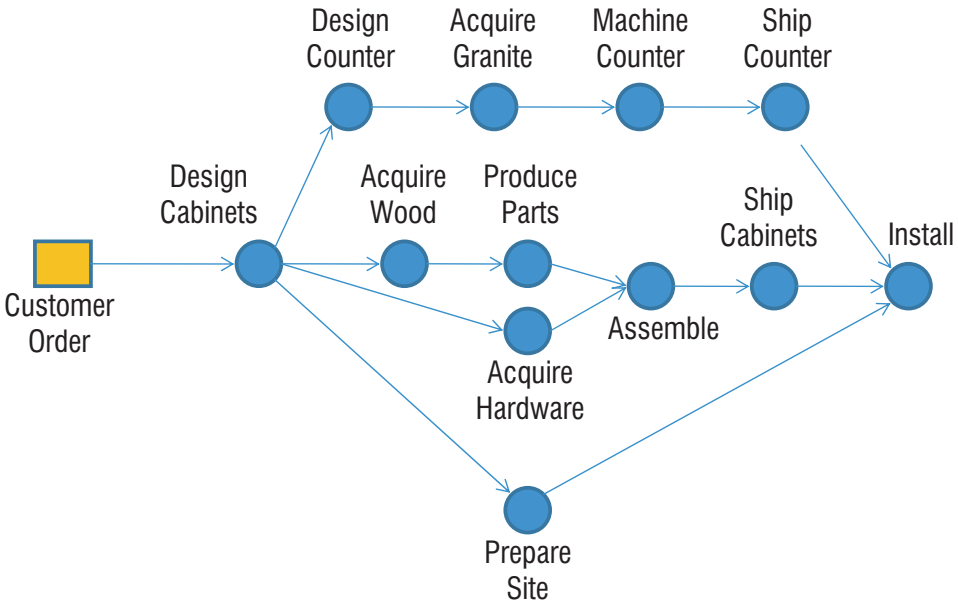

Figure 1 — Value chain network.

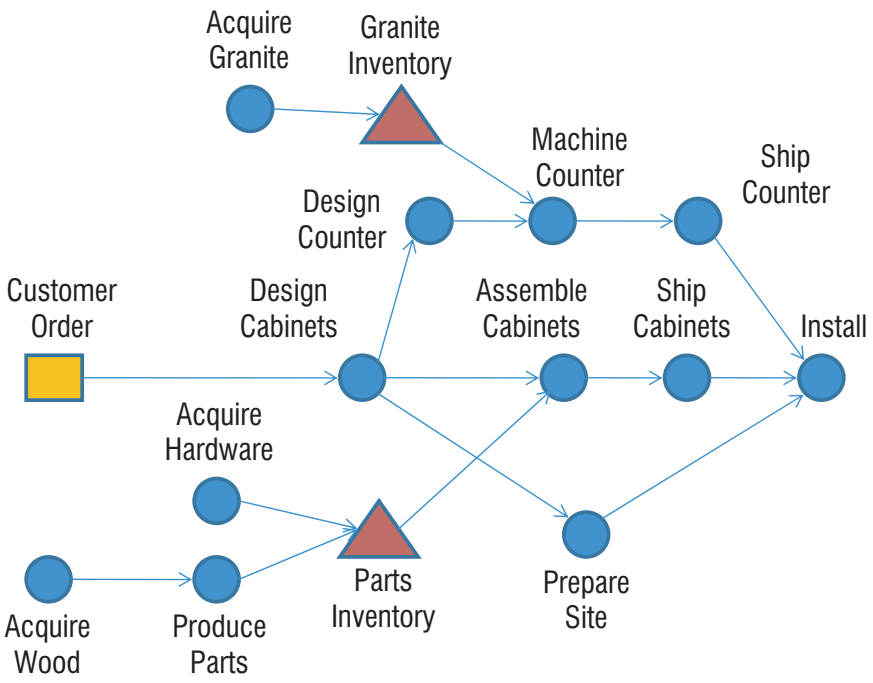

Figure 2 — Production from inventory.

Customer Order and Install do not include the acquisition of granite, hardware, and wood, nor the machining of parts.

The value chain dependencies also provide a basis for considering the impact of operational delays and failures. Inventories provide flexibility in timing such that failure of an inventory-producing capability does not affect customer delivery until the inventory is depleted.

Product Variations

A value chain model may represent the delivery of multiple products (or services) or a single product (or service) with variations to meet different customer requirements. For example, in the auto industry, a single product line may have multiple models and many options. The capabilities required are fundamentally the same for each unit of production, but some capabilities may not be used on all product variations, and some capabilities may involve more time and cost for some product variations.

Cost, Time, and Quality Models

A value chain model should support the analysis of cost, time, and quality for each value chain activity and associated product variations.

Costs will depend on the extent to which resource use is optimized. (Optimization factors are discussed further below.) Cost computations should be performed on production volumes representing significant product variations for past or future operating periods in order to arrive at representative average costs per unit. The cost of a value chain activity must also reflect the allocation of fixed costs and overhead per unit of production, so cost per unit will depend on production volumes.

Throughput time for an activity will be affected by product variations as well as production capacity and demand variations. If there is insufficient capacity, then an activity may become a bottleneck, delaying production on individual units. If there is an excess of capacity, then cost per unit will increase. If there are surges in demand, delays may occur during peak periods.

Defect and rework data should be captured to provide insights on quality. These may add to time and cost, and in some cases may impact the quality of products delivered to the customer.

Organization Alignment

Responsibility for each activity in the value chain must be identified by associating the supporting capability with the responsible organization. As noted earlier, the groupings of activities into more abstract activities may not align to the management hierarchy. The modeler should be able to redefine the groupings and recommend organizational changes, considering different factors that may lead to closer alignment with the

organization hierarchy and thus more effective optimization, accountability, and control.

Information Systems Alignment

Each capability should include references to the automated business processes and applications that support it. This will encourage better alignment of systems to business needs.

Business Process Alignment

Business processes will drive the execution of value chain activities. The design of these business processes will determine the optimization of resource utilization and the tradeoffs made between cost and response time as well as the potentially competing interests of multiple LOBs. The value chain model will not directly model business processes, but it will define a framework for business process design and optimization, as discussed below.

HOW THE VALUE CHAIN MODEL RELATES TO ENTERPRISE OPERATION

In this section, I will examine in greater detail the relationship of a value chain model to the operation of the enterprise. I will start by considering the relationship of the value chain to business processes and the design of information systems. Then I will consider the organizational impact and, finally, discuss support for optimization from an enterprise perspective.

Business Process Architecture

Operating at three levels in support of the value chain, business processes:

1. Define when and how capabilities are engaged to produce the customer value for an LOB
2. Define how capabilities perform value chain activities
3. Support the management, maintenance, and optimal operation of capabilities

Figure 3 focuses on the Produce Parts capability (from Figure 2) as a shared service. Not surprisingly, the Produce Parts service has an internal business process for producing parts. The service produces batches of parts to inventory in order to minimize the setup cost per unit. The service is engaged (arrows at the top) by business processes that determine production schedules based on forecasts of customer orders. Acquire Wood and Parts Inventory are the associated value chain activities. This diagram highlights the distinction between

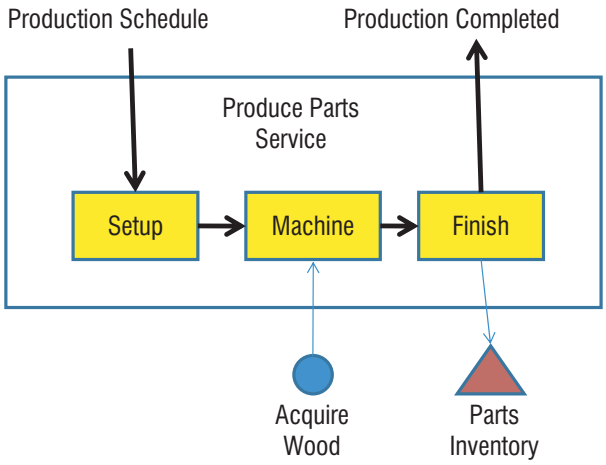

Figure 3 — Business process alignment to the value chain.

the control exercised by business processes and the dependencies of the value chain.

There will be a variety of internal business capabilities that support the mainstream value chain capabilities, including accounting, human resource (HR) management, procurement, facilities maintenance, and IT development and operations. These are part of the overhead of value chain capabilities that must be factored into costs. Each of these may be viewed as an internal value chain serving the needs of its internal customers. In general, the primary value chain capabilities are those that have a direct impact on the delivery of customer value. In some cases, a capability may be included or excluded from the value chain based on the modeler's judgment and the capability's relevance to analysis of the value chain.

The value chain may include capabilities that are outsourced. The internal business processes of those capabilities may thus be private to the capability provider, but the value chain dependencies and the business process interactions should be well defined. If the capability shown in Figure 3 were outsourced, it could appear as a "black box" but have the same inputs and outputs.

IT Support

The IT organization provides support services for the utilization of IT for automation, integration, and collaboration. The value chain models provide a framework for aligning information systems with the business.

Business processes that implement a line of business and engage shared capabilities are owned by the LOB manager. This manager will define requirements for integration and automation of these processes and their associated tasks within enterprise optimization

constraints. Note that some capabilities are unique to an LOB and may be still owned by the LOB manager.

The business processes and tasks that define the operation and management of each of the capabilities are owned by each capability manager and must be appropriate to the differing requirements of the multiple LOBs served by the capability. Processes within capabilities should begin and end within the capability organization so as to support loose coupling and enable independent, local improvements.

The focus on management and utilization of capabilities leads to the need for a matrix organization.

In most cases, the automation of repeatable business processes should be implemented with a business process management system (BPMS) that enables process owners to define, view, analyze, and modify their business processes with minimal technical support. However, where capabilities involve minimal human participation or little variability in the process, optimal performance may be achieved with programmed solutions. Other processes that involve ad hoc human planning and decision making may be addressed by case management systems.[5]

The Matrix Organization

The focus on management and utilization of capabilities leads to the need for a matrix organization. Shared capabilities should be managed independently of the LOBs they support so that they are not biased to support any particular LOB. On the other hand, each LOB should be managed for success, considering market demands and capability requirements.

Figure 4 illustrates the relationships of LOB management (rows) and capability management (columns), with capability uses indicated by dark cells. Here the hypothetical vendor has two LOBs that share some capabilities (dark cells). This is essentially an alternative view of two value chains. The capabilities are grouped into larger departments that focus on management of similar resources. Essentially the LOB managers are the internal customers of the capability managers.

Support Services

In Porter's value chain model, business functions such as procurement, HR, and finance are supporting services that do not contribute directly to the creation of customer value. These are shared capabilities that were consolidated early in the development of business organizations both for economies of scale and control. IT is a more recently defined shared capability. Such functions may also be modeled with value chains, but their value chains serve the needs of internal customers. They are part of the general business capability and cost of delivering value to the end customer. Value chain analysis may identify other capabilities that can be removed from mainstream operations and provided as supporting services, such as the pooling of shipping containers for multiple LOBs.

Enterprise Optimization

Enterprise optimization should be considered from three key perspectives:

1. Optimization of customer value for each LOB
2. Optimization of cost, quality, and timeliness of activities performed by each capability
3. Optimization of agility to respond to changing business needs

Enterprise optimization requires an enterprise-level activity to model and support analysis and design of enterprise operations independent of the more specific

	Engineering		Production			Field Support	
	Parts	Cabinets	Machining	Assembly	Shipping	Installation	Repair
Cabinets LOB	■	■	■	■	■	■	■
Millwork LOB	■		■		■		

Figure 4 — Matrix organization.

interests of LOB or capability managers. The IT organization should have a unique role in this enterprise optimization activity, first in identifying opportunities to exploit IT and then in providing a cross-enterprise perspective on the design and integration of supporting information systems.

BUSINESS BENEFITS

Enhanced Customer Value

Existing and potential customer value can be protected and improved through identification of contributing capabilities and their roles in the context of associated value chains. Customer value and associated capability requirements arising from changing market demands can be more effectively assessed and focused on development or improvement of existing business processes and capabilities.

Improved Governance

Value chain models will provide an executive viewpoint on business processes and capabilities that will support more effective governance. A model provides the linkage between customer value, the capabilities needed to produce customer value, the responsible organizations, and the information systems that support them. The impact of policies and regulations or other external influencers can be more quickly analyzed and enforced by focusing on affected capabilities. Executives are better able to evaluate performance, exercise control, and consider new business opportunities as well as strategies for improving competitive advantage.

Economies of Scale

Similar capabilities can be identified and consolidated for economies of scale, such as more effective workload balancing or development of specialists. Exposing these capabilities as shared services improves flexibility and promotes independence from particular LOBs. Improvements to shared capabilities can be considered in the context of multiple value chains to optimize changes and investments from an enterprise perspective and potentially balance competing interests. Shared capabilities that do not provide unique customer value may be considered for outsourcing. Outsourcing takes advantage of economies of scale and specialization across multiple enterprises and may become necessary for the enterprise to remain competitive.

Focused Process Improvement

Specification of shared capabilities as services and alignment of business processes to capabilities enable managers of specific capabilities to optimize their internal processes with little or no impact on the processes that engage those services or the related business operations. This supports delegation of authority and enables local initiatives to improve operations. Value chain analysis may also facilitate discovery of new business models, such as the elimination of capabilities through disintermediation.

The impact of new requirements can be more quickly assessed in the value chain context.

Agile Business Adaptation

The clarification of capabilities and the configuration of value chains as alternative uses of shared services enable more rapid and effective adaptation of the enterprise to new business demands and opportunities, including new applications of IT. The impact of new requirements can be more quickly assessed in the value chain context. Changes to a capability can be implemented just once if the capability is consolidated. If capabilities have well-defined scope and interfaces, the enterprise can enable new business models or support new LOBs through easy reconfiguration of the value chain rather than development of new organizations and capabilities.

Business-IT Alignment

A value chain perspective and composition of value chains from shared capabilities provide the basis for a flexible technical architecture for integration, business process automation, and automation of business operations within capabilities. The value chain defines distinct owners for lines of business and capabilities. Automation can be better aligned with the operations of individual capabilities, avoiding tight coupling between capabilities that would restrict local initiatives and enterprise agility.

Funding of IT projects can be planned from an enterprise perspective while enabling projects to focus on the need to improve specific capabilities. The value chain also facilitates discovery of opportunities to

exploit technology in ways that change the market through new relationships with customers and business partners.

CONCLUSION

While value chain modeling has been around for many years, the lack of a robust, computer-based modeling language to manage the complexity has limited its business benefits. The use of value chain models to identify and manage shared business capabilities across multiple LOBs is a key aspect of a new business paradigm in which:

- The value chain provides a framework for the design of business processes.
- LOBs are designed as value chains that engage shared services.
- Performance improvement and investment in automation and transformation are optimized at an enterprise level.

The OMG process for development of a Value Delivery Metamodel standard for value chain modeling will receive initial proposals in early 2010. Some work on the development of implementations will occur concurrently with the development of a standard. In the long term, value chain modeling will be a key viewpoint in enterprise architecture models supporting assessment, analysis, planning, design, transformation, and automation of enterprise operations.[6]

ENDNOTES

[1]Porter, Michael. *Competitive Advantage: Creating and Sustaining Superior Performance*. The Free Press, 1985.

[2]"eTOM Business Process Framework (eTOM) in Depth." TeleManagement Forum (www.tmforum.org/BestPracticesStandards/BusinessProcessFramework/6637/Home.html).

[3]"Value Delivery Metamodel RFP." Object Management Group (OMG), 26 March 2009 (http://doc.omg.org/bmi/2009-03-09).

[4]Stabell, Charles B., and Øystein D. Fjeldstad. "Configuring Value for Competitive Advantage: On Chains, Shops and Networks." *Strategic Management Journal*, Vol. 19, No. 5, 1998, pp. 413-417.

[5]"Case Management Process Modeling RFP." OMG, 22 September 2009 (www.omg.org/cgi-bin/doc?bmi/09-09-23).

[6]For more on this emerging business paradigm, see Cummins, Fred, *Building the Agile Enterprise with SOA, BPM, and MBM*, Elsevier, 2009.

Fred Cummins is an HP Fellow involved in industry standards, BPM, SOA, and cloud computing. He is Co-Chair of the OMG Business Modeling and Integration Domain Task Force that is responsible for the Value Delivery Metamodel (VDM), Business Process Model and Notation (BPMN), and Case Management Process Modeling (CMPM) specifications, as well as other business-oriented specifications. He is a leader in the development of the OMG VDM specification. Mr. Cummins can be reached at fred.cummins@hp.com.