Supply-Chain Operations Reference-model

PLAN SOURCE MAKE DELIVER RETURN

SCOR Overview

Version 9.0

Supply-Chain Council

Supply-Chain Operations Reference-model

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The Supply-Chain Operations Reference-model (SCOR) is the product of the Supply-Chain Council (SCC), an independent, not-for-profit, global corporation with membership open to all companies and organizations interested in applying and advancing the state-of-the-art in supply-chain management systems and practices. The SCOR-model captures the Council's consensus view of supply chain management. While much of the underlying content of the Model has been used by practitioners for many years, the SCOR-model provides a unique framework that links business process, metrics, best practices and technology features into a unified structure to support communication among supply chain partners and to improve the effectiveness of supply chain management and related supply chain improvement activities.

Member companies pay a modest annual fee to support Council activities. All who use the SCOR-model are asked to acknowledge the SCC in all documents describing or depicting the SCOR-model and its use. The complete SCOR-model and other rleated models of the SCC are accessable through the members' section of the **www.supply-chain.org** website. SCC members further model development by participating in project development teams- SCOR and other related SCC Models are collaborative ongoing projects that seek to represent current supply chain and related practice.

Further information regarding membership, the Council and SCORcan be found at the Council's web site: **www.supply-chain.org.**

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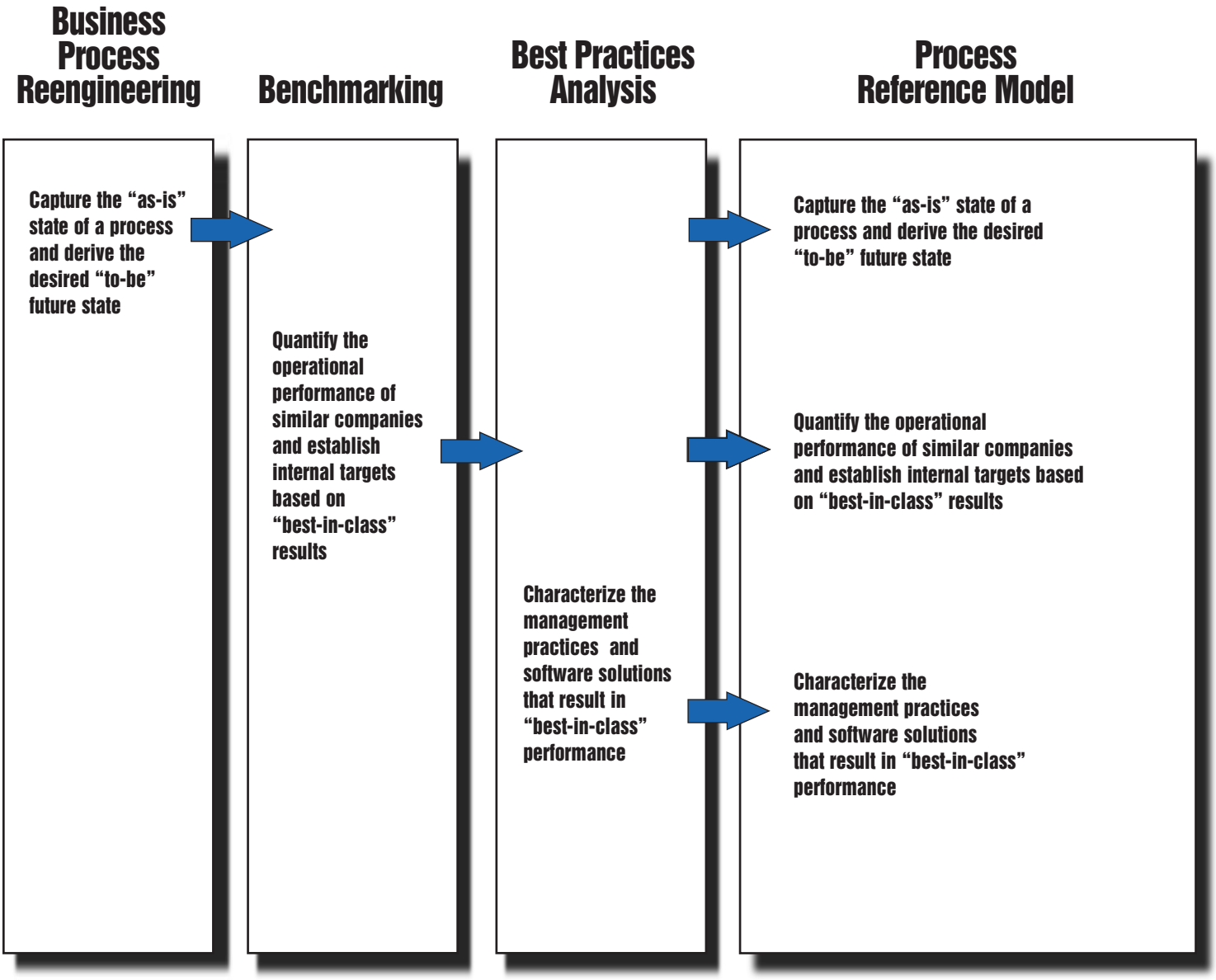
SCOR® Supply-Chain Council

What Is a Process Reference Model?

Section ONE

Process reference models integrate the well-known concepts of business process reengineering, benchmarking, and process measurement into a cross-functional framework.



A Process Reference Model Contains:

- Standard descriptions of management processes
- A framework of relationships among the standard processes
- Standard metrics to measure process performance
- Management practices that produce best-in-class performance
- Standard alignment to features and functionality

Once a Complex Management Process is Captured in Standard Process Reference Model Form, It can Be:

- Implemented purposefully to achieve competitive advantage
- Described unambiguously and communicated
- Measured, managed, and controlled
- Tuned and re-tuned to a specific purpose

▶ A Process Reference Model Becomes a Powerful Tool in the Hands of Management

Section
TWO

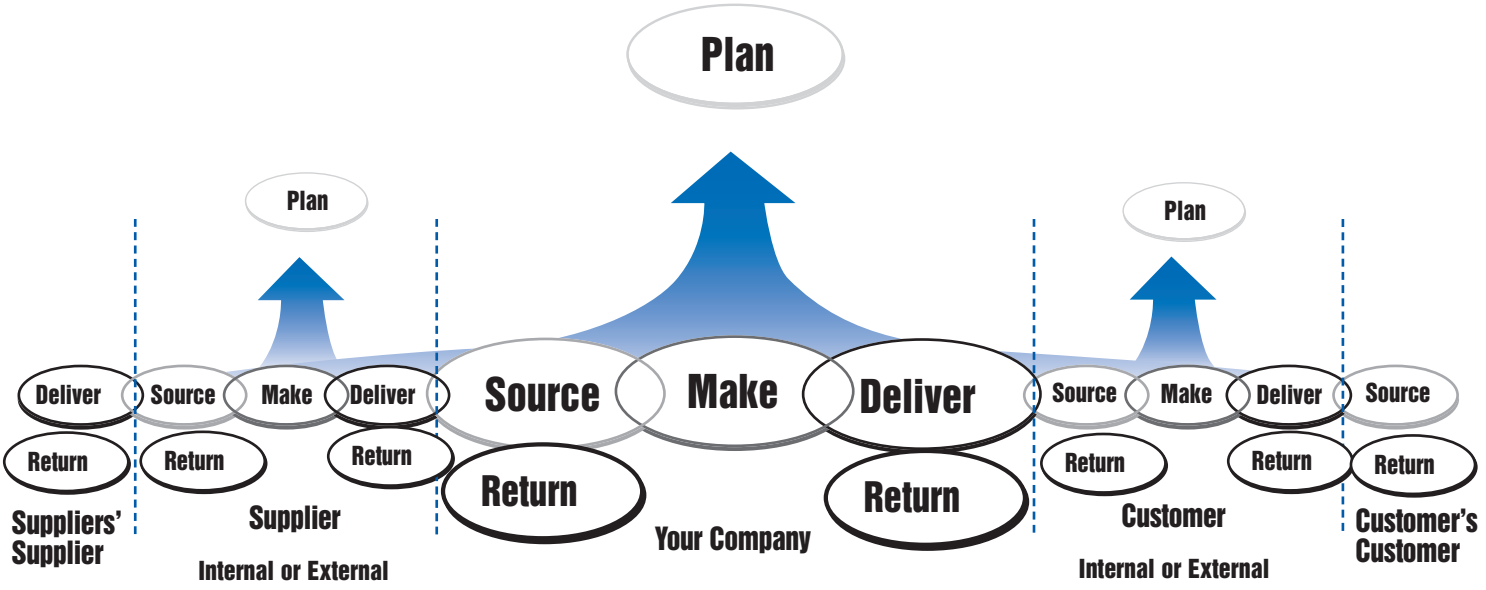
Model
Scope and Structure

The Boundaries of Any Model Must Be Carefully Defined

"From your supplier's supplier to your customer's customer"

SCOR spans:

- All customer interactions, from order entry through paid invoice
- All product (physical material and service) transactions, from your supplier's supplier to your customer's customer, including equipment, supplies, spare parts, bulk product, software, etc.
- All market interactions, from the understanding of aggregate demand to the fulfillment of each order



SCOR does not attempt to describe every business process or activity, including:

- Sales and marketing (demand generation)
- Research and technology development
- Product development
- Some elements of post-delivery customer support

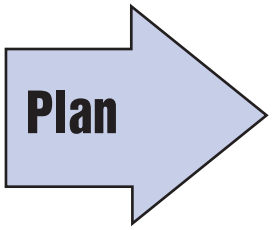
Links can be made to processes not included within the model's scope, such as product development, and some are noted in SCOR.

SCOR assumes but does not explicitly address:

- Training
- Quality
- Information Technology (IT)
- Administration (non SCM)

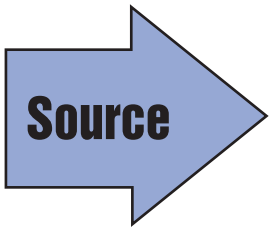
Scope of SCOR Processes

SCOR is Based on Five Distinct Management Processes



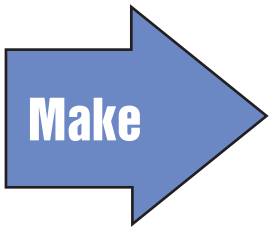
Demand/Supply Planning and Management

- Balance resources with requirements and establish/communicate plans for the whole supply chain, including Return, and the execution processes of Source, Make, and Deliver.
- Management of business rules, supply chain performance, data collection, inventory, capital assets, transportation, planning configuration, regulatory requirements and compliance, and supply chain risk.
- Align the supply chain unit plan with the financial plan.



Sourcing Stocked, Make-to-Order, and Engineer-to-Order Product

- Schedule deliveries; receive, verify, and transfer product; and authorize supplier payments.
- Identify and select supply sources when not predetermined, as for engineer-to-order product.
- Manage business rules, assess supplier performance, and maintain data.
- Manage inventory, capital assets, incoming product, supplier network, import/export requirements, supplier agreements, and supply chain source risk.



Make-to-Stock, Make-to-Order, and Engineer-to-Order Production Execution

- Schedule production activities, issue product, produce and test, package, stage product, and release product to deliver. With the addition of Green to SCOR, there are now processes specifically for Waste Disposal in MAKE.
- Finalize engineering for engineer-to-order product.
- Manage rules, performance, data, in-process products (WIP), equipment and facilities, transportation, production network, regulatory compliance for production, and supply chain make risk.

Order, Warehouse, Transportation, and Installation Management for Stocked, Make-to-Order, and Engineer-to-Order Product

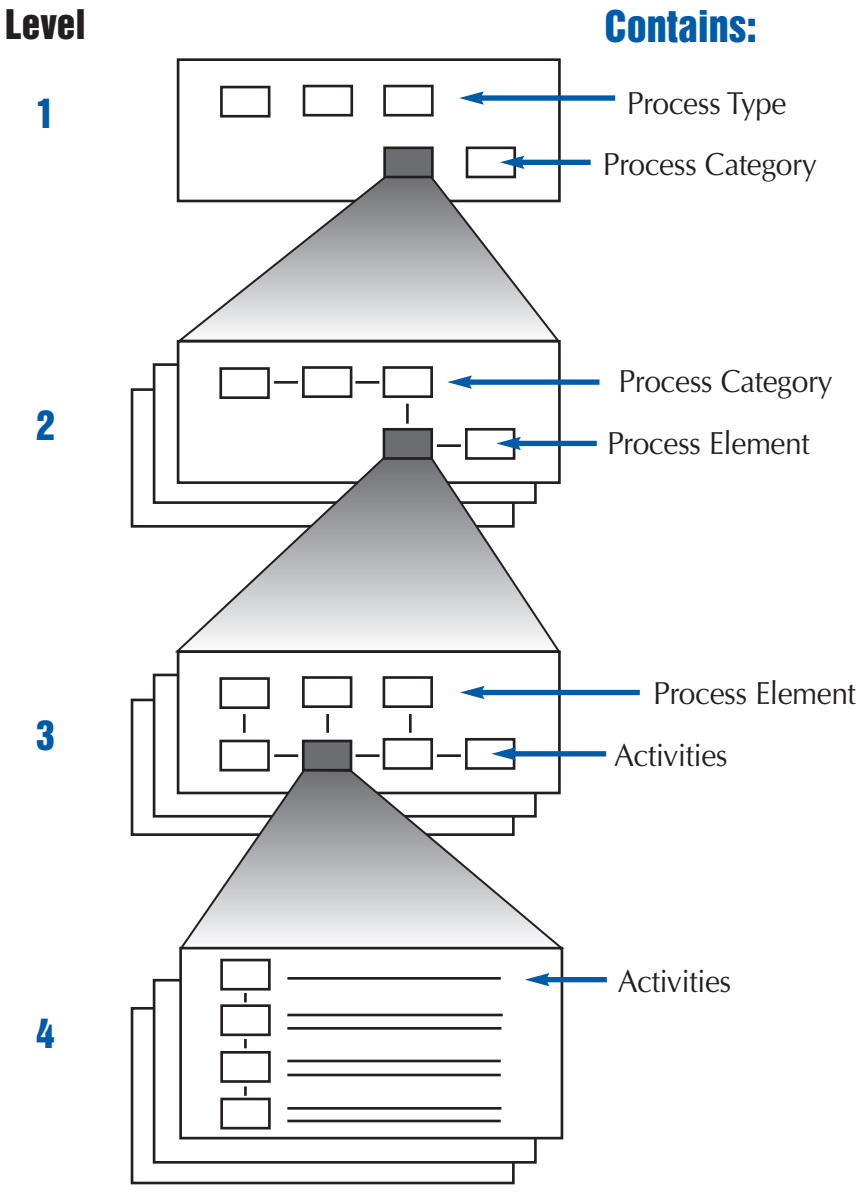
- All order management steps from processing customer inquiries and quotes to routing shipments and selecting carriers.
- Warehouse management from receiving and picking product to load and ship product.
- Receive and verify product at customer site and install, if necessary.
- Invoicing customer.
- Manage Deliver business rules, performance, information, finished product inventories, capital assets, transportation, product life cycle, import/export requirements, and supply chain deliver risk.

Return of Raw Materials and Receipt of Returns of Finished Goods

- All Return Defective Product steps from source – identify product condition, disposition product, request product return authorization, schedule product shipment, and return defective product – and deliver – authorized product return, schedule return receipt, receive product, and transfer defective product.
- All Return Maintenance, Repair, and Overhaul product steps from source – identify product condition, disposition product, request product return authorization, schedule product shipment, and return MRO product – and deliver – authorize product return, schedule return receipt, receive product, and transfer MRO product.
- All Return Excess Product steps from source – identify product condition, disposition product, request product return authorization, schedule product shipment, and return excess product – and deliver – authorize product return, schedule return receipt, receive product, and transfer excess product.
- Manage Return business rules, performance, data collection, return inventory, capital assets, transportation, network configuration, regulatory requirements and compliance, and supply chain return risk.

A Process Reference Model Differs from Classic Process Decomposition Models

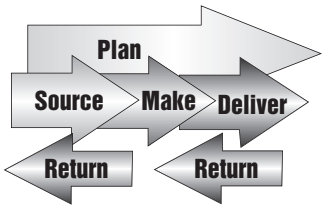
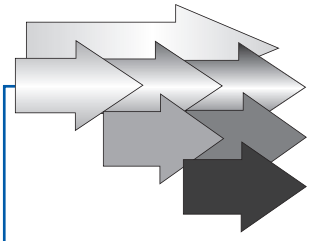
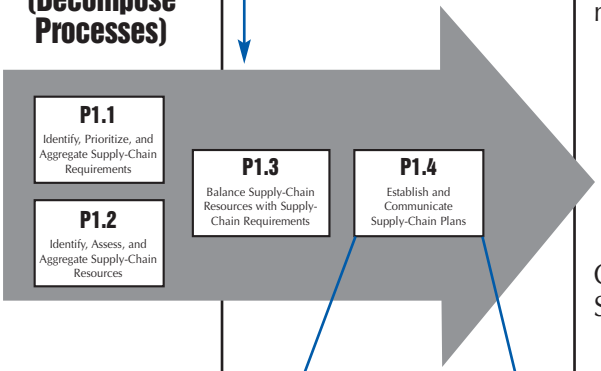
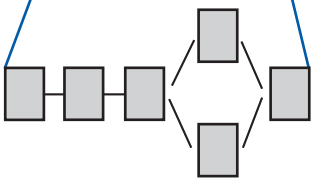
- **Process decomposition models are developed to address one specific configuration of process elements**



- **Provide a balanced horizontal (cross-process) and vertical (hierarchical) view**
- **Designed to be (re)configurable**
- **Used to represent many different configurations of a similar process**
- **Aggregate a series of hierarchical process models**

SCOR Contains Three Levels of Process Detail

Level

	#	Description	Schematic	Comments
Supply-Chain Operations Reference-model	1	Top Level (Process Types)		Level 1 defines the scope and content for the Supply Chain Operations Reference-model. Here basis of competition performance targets are set.
	2	Configuration Level (Process Categories)		A company's supply chain can be "configured-to-order" at Level 2 from core "process categories." Companies implement their operations strategy through the configuration they choose for their supply chain.
	3	Process Element Level (Decompose Processes)		Level 3 defines a company's ability to compete successfully in its chosen markets, and consists of: • Process element definitions • Process element information inputs, and outputs • Process performance metrics attributes and defintions • Best practices definitions Companies "fine tune" their Operations Strategy at Level 3.
Not in Scope	4	Implementation Level (Decompose Process Elements)		Companies implement supply-chain management practices that are unique to their organizations at this level. Level 4 and lower defines specific practices to achieve competitive advantage and to adapt to changing business conditions.

Process Categories

Defined by the Relationship Between a SCOR Process and a Process Type

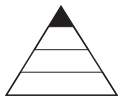
"SCOR Configuration Toolkit"

		SCOR Process					
		Plan	Source	Make	Deliver	Return	
Process Type	Planning	P1	P2	P3	P4	P5	Process Category
	Execution		S1 - S3	M1 - M3	D1 - D4	S/DR1 - S/DR3	
	Enable	EP	ES	EM	ED	ER	

Practitioners select appropriate process categories from the SCOR configuration toolkit to represent their supply-chain configuration(s).

Level 1 Process Definitions

SCOR Is Based on Five Core Management Processes



SCOR Process	Definitions
Plan	Processes that balance aggregate demand and supply to develop a course of action which best meets sourcing, production and delivery requirements
Source	Processes that procure goods and services to meet planned or actual demand
Make	Processes that transform product to a finished state to meet planned or actual demand
Deliver	Processes that provide finished goods and services to meet planned or actual demand, typically including order management, transportation management, and distribution management
Return	Processes associated with returning or receiving returned products for any reason. These processes extend into post-delivery customer support

At Level 2, Each Process Can Be Further Described by Type

SCOR Process Type	Characteristics
Planning	A process that aligns expected resources to meet expected demand requirements. Planning processes: • Balance aggregated demand and supply • (Generally) occur at regular, periodic intervals • Consider consistent planning horizon • Can contribute to supply-chain response time
Execution	A process triggered by planned or actual demand that changes the state of material goods. Execution processes: • Generally involve - 1. Scheduling/sequencing 2. Transforming product, and/or 3. Moving product to the next process • Can contribute to the order fulfillment cycle time
Enable	A process that prepares, maintains, or manages information orrelationships on which planning and execution processes rely

Each Execution Process has three different possible capabilities of representing and responding to customer orders. Different supply chain strategy supports corresponding product or service types. These categories also affect PLAN and RETURN processes.

Stocked Product (S1, M1, D1)

- Inventory Driven (Plan)
- Standard Material Orders
- High Fill-rate, short turnaround

Example: A retail air conditioner which is pulled off the shelf, and restocked based on SKU.

Make-to-Order (S2, M2, D2)

- Customer Order Driven
- Configurable Materials
- Longer turn-around times

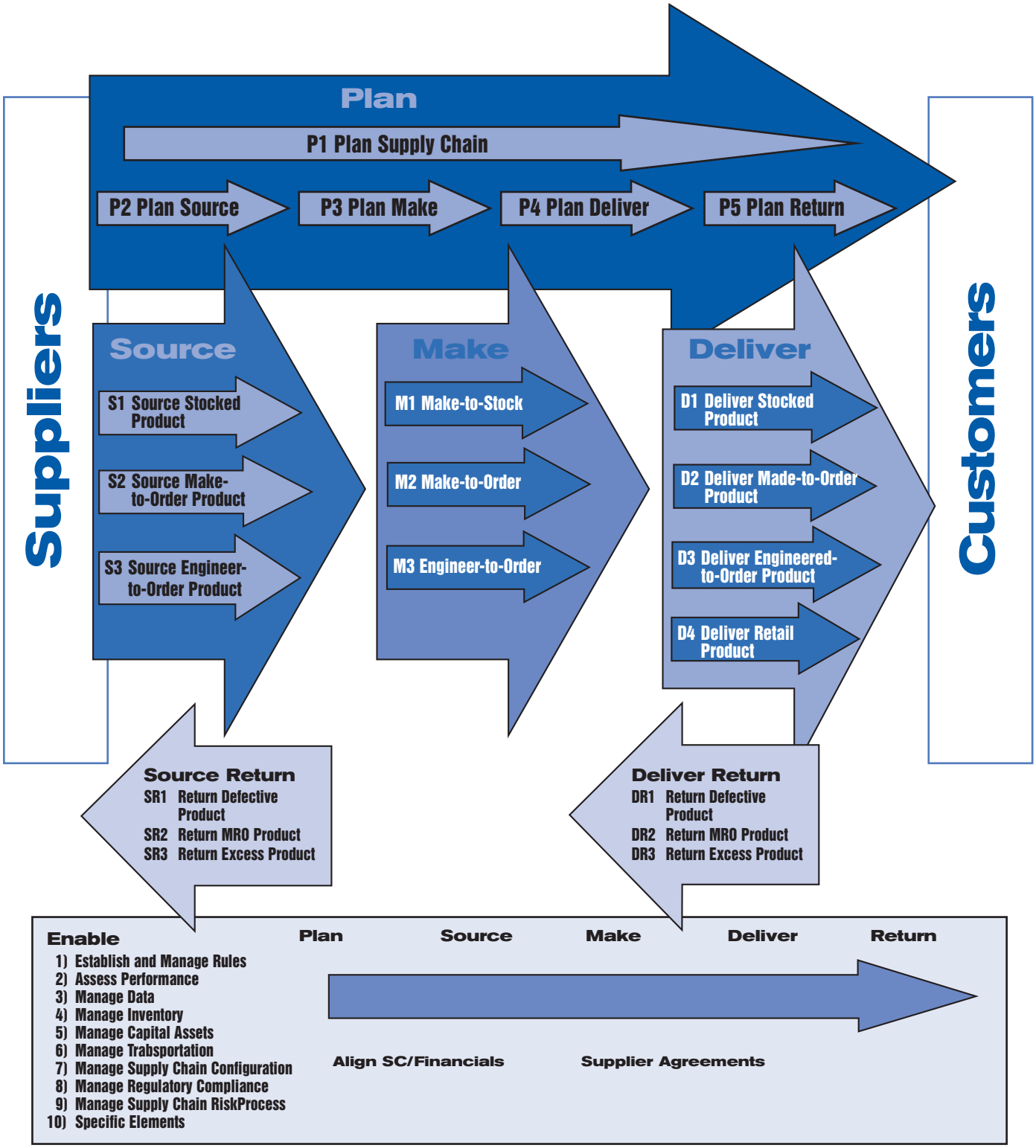
Example: A car is built with a particular combination of colors and features and ordered from a distributor.

Engineer-to-Order (S3, M3, D3, D4)

- Customer Requirements Driven
- Sourcing New Materials
- Longest long lead-times, low fill rates

Example: An architect and engineer creates a new kitchen for you, with some custom-build and custom-sourced materials.

SCOR Version 9.0 Level 2



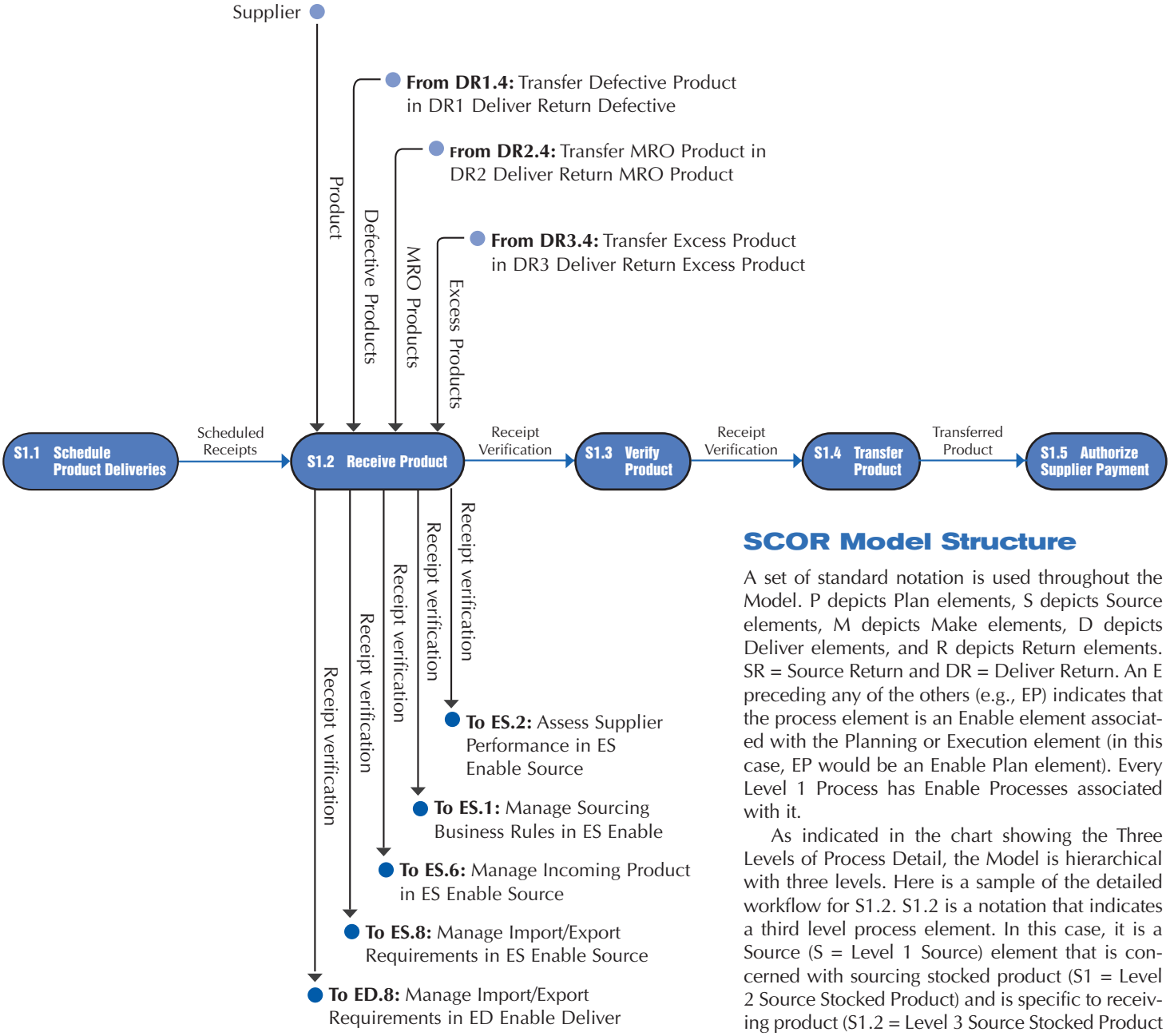
SCOR Level 3

Presents Detailed Process Element Information for Each Level 2 Process Category

- Process flow
- Inputs and outputs
- Source of inputs
- Output destination

S1 Source Stocked Product

S1.2 Detail



SCOR Model Structure

A set of standard notation is used throughout the Model. P depicts Plan elements, S depicts Source elements, M depicts Make elements, D depicts Deliver elements, and R depicts Return elements. SR = Source Return and DR = Deliver Return. An E preceding any of the others (e.g., EP) indicates that the process element is an Enable element associated with the Planning or Execution element (in this case, EP would be an Enable Plan element). Every Level 1 Process has Enable Processes associated with it.

As indicated in the chart showing the Three Levels of Process Detail, the Model is hierarchical with three levels. Here is a sample of the detailed workflow for S1.2. S1.2 is a notation that indicates a third level process element. In this case, it is a Source (S = Level 1 Source) element that is concerned with sourcing stocked product (S1 = Level 2 Source Stocked Product) and is specific to receiving product (S1.2 = Level 3 Source Stocked Product Receive Product). Though the other S1 processes are shown here to Level 2, the Level 3 detail is only included for S1.2.

Examples

SCOR Level 3 Standard Process Element Definition, Performance Process Table

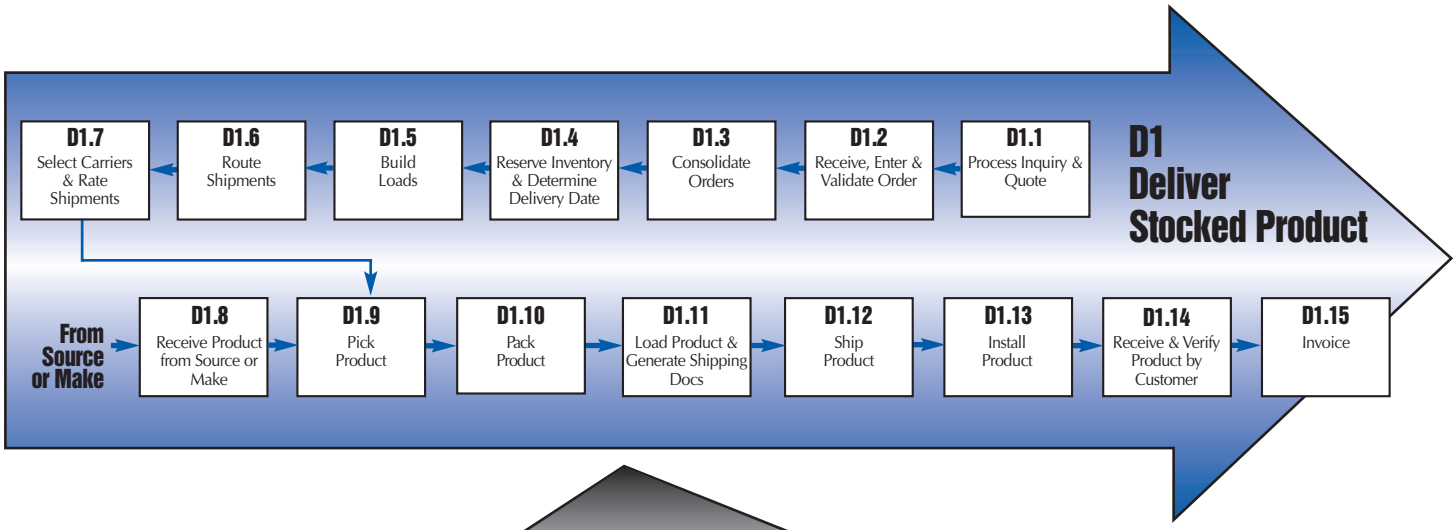
S1.1

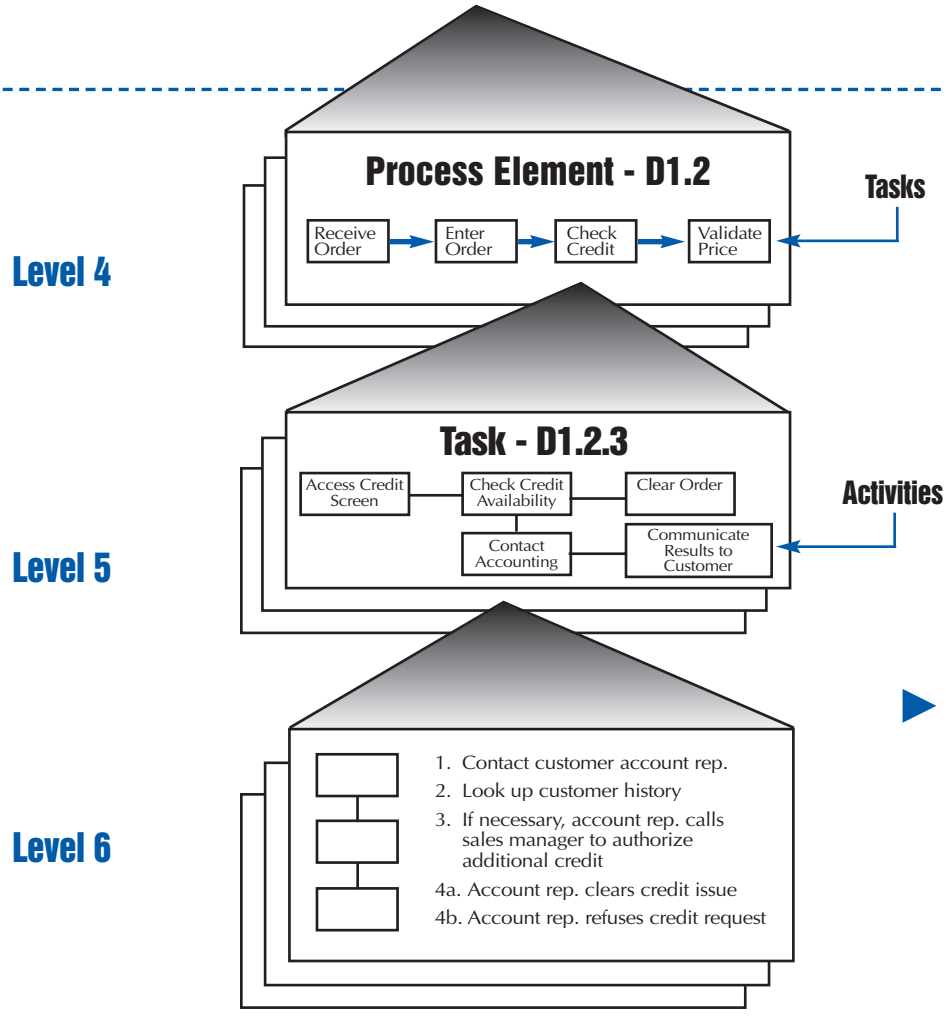
Schedule Product Deliveries

Scheduling and managing the execution of the individual deliveries of product against an existing contract or purchase order. The requirements for product releases are determined based on the detailed sourcing plan or other types of product pull signals.

Performance Attributes	Metric
Supply Chain Reliability	% Schedules Changed within Supplier's Lead Time
Supply Chain Responsiveness	Average Release Cycle of Changes, Average Days per Engineering Change, Schedule Product Deliveries Cycle Time, Average Days per Schedule Change
Supply Chain Agility	None Identified
Supply Chain Costs	Cost to Schedule Product Deliveries, Quantity per shipment
Supply Chain Asset Management	None Identified
Best Practices	**Description/Definition**
Bundle deliveries	Bundle deliveries of different products into single shipment when possible
Infrequent product delivery	Minimize need for frequent shipments by accurately determining product needs
Mechanical (Kanban) Pull Signals Are Used to Notify Suppliers of the Need to Deliver Product	Electronic Kanban support
Supplier managed inventories with scheduling interfaces to external supplier systems	VMI agreements allow suppliers to manage (replenish) inventory
Utilize EDI Transactions to Reduce Cycle Time and Costs	EDI interface for 830, 850, 856 & 862 transactions
Advanced Ship Notices Allow for Tight Synchronization between Source and Make Processes	Blanket order support with scheduling interfaces to external supplier systems
Consignment Agreements Are Used to Reduce Assets and Cycle Time While Increasing the Availability of Critical Items	Consignment inventory management

Implementation of Supply-Chain Management Practices within the Company Occurs at Level 4 *(and below)*





Below Level 3, each process element is described by classic hierarchical process decomposition

Performance Attributes and Level 1 Strategic Metrics

Level 1 Strategic Metrics are primary, high level measures that may cross multiple SCOR processes. Level 1 Metrics do not necessarily relate to a SCOR Level 1 process (PLAN, SOURCE, MAKE, DELIVER, RETURN).

Level 1 Metrics	Performance Attributes				
	Customer-Facing			Internal-Facing	
	Reliabilty	Responsiveness	Agility	Cost	Assets
Perfect Order Fulfillment (RL.1.1)	✓				
Order Fulfillment Cycle Time (RS.1.1)		✓			
Upside Supply Chain Flexibility (AG.1.1)			✓		
Upside Supply Chain Adaptability (AG.1.2)			✓		
Downside Supply Chain Adaptability (AG.1.3)			✓		
Supply Chain Management Cost (CO.1.1)				✓	
Cost of Goods Sold (CO.1.2)				✓	
Cash-to-Cash Cycle Time (AM.1.1)					✓
Return on Supply Chain Fixed Assets (AM.1.2)					✓
Return on Working Capital (AM.1.2)					✓

The Metrics are used in conjunction with Performance Attributes. The Level 1 Strategic Metrics are the calculations by which an implementing organization can measure how successful they are in achieving their desired positioning within the competitive market space. Many metrics in the Model are hierarchical – just as the process elements are hierarchical. Level 1 Metrics are created from lower level calculations and are primary, high level measures that may cross multiple SCOR processes. Lower level calculations (Level 2 and 3 metrics) are generally associated with a narrower subset of processes. Level 2 and 3 metrics associated with Level 1 metrics are included in the 9.0 Metrics Hierarchy in the Metrics Chapter. Additional metrics that do not "roll up" to Level 1 are needed as diagnostics (used to diagnose variations in performance against plan) and are included in the Metrics Chapter with definitions and process locations listed.

SCOR metrics are used in conjunction with Performance Attributes. The Performance Attributes are characteristics of the supply chain that permit it to be analyzed and evaluated against other supply chains with competing strategies. Just as you would describe a physical object like a piece of lumber using standard characteristics (e.g., height, width, depth), a supply chain requires standard characteristics to be described. Without these characteristics it is extremely difficult to compare an organization that chooses to be the low-cost provider against an organization that chooses to compete on reliability and performance.

In SCOR 9.0 metrics coding is introduced. This will simplify identification, eliminate confusion for similar-sounding metrics and is particularly beneficial for benchmarking as it is based on the Performance Attributes of the metrics.

The format of the metric ID or number is XX.y.z, where: XX = Performance Attribute. The possible values for XX are:

- RL = Reliability, _
- RS = Responsiveness, _
- AG = Agility, _
- CO= Cost, and _
- AM = Asset Management. _

y = Level of the metric
z = a unique number

Examples: The metric ID for Perfect Order Fulfillment is RL.1.1. From this you can derive that Perfect Order Fulfillment is a strategic (Level 1) Reliability metric. An example of a level 2 (diagnostic metric) is RL.2.4: Perfect Condition. Level 3 diagnostic metrics are coded the same way; the unique number has been assigned based on the alphabetical listing. Future metric additions will simply receive an incremental number. An example of a level 3 diagnostic metric is CO.3.141 (Direct Material Cost).

Section THREE

Applying the SCOR Model

The Concept of "Configurability"

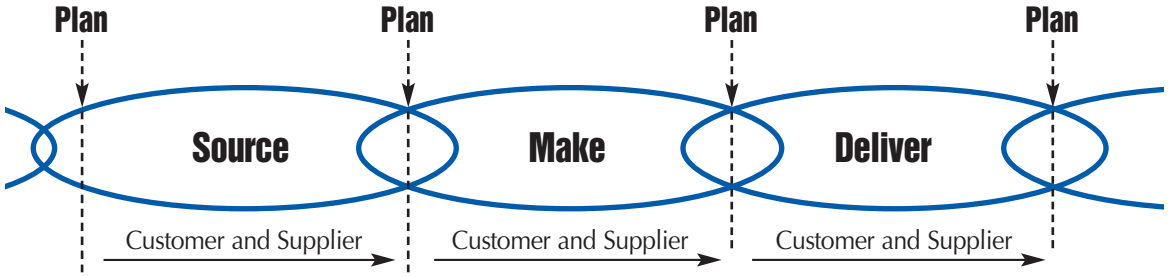
A supply-chain configuration is driven by:

- **Plan** levels of aggregation and information sources
- **Source** locations and products
- **Make** production sites and methods
- **Deliver** channels, inventory deployment and products
- **Return** locations and methods

SCOR must accurately reflect how a supply-chain's configuration impacts management processes and practices.

Each Basic Supply-Chain is a "Chain" of Source, Make, and Deliver Execution Processes

Configurability



Each intersection of two execution processes (Source-Make-Deliver) is a "link" in the supply chain

- Execution processes transform or transport materials and/or products
- Each process is a customer of the previous process and a supplier to the next

Planning processes manage these customer-supplier links

- Planning processes thus "balance" the supply chain
- Every link "requires" an occurrence of a plan process category

Modeling with SCOR

Drivers for modeling: Why model?

Business opportunities:

- Strategy Development
- Merger, Acquisition or Divestiture (Companies or Supply Chains)
- Process optimization and Re-engineering
- Standardization, Streamlining and Management alignment
- New business start-up (Company and Supply Chain start-ups)
- Benchmarking
- Process Outsourcing

Technology services:

- Software implementation (ERP, PLM, QC)
- Workflow & Service Oriented Architecture

SCOR recognizes different types of models. Each serves a different purpose:

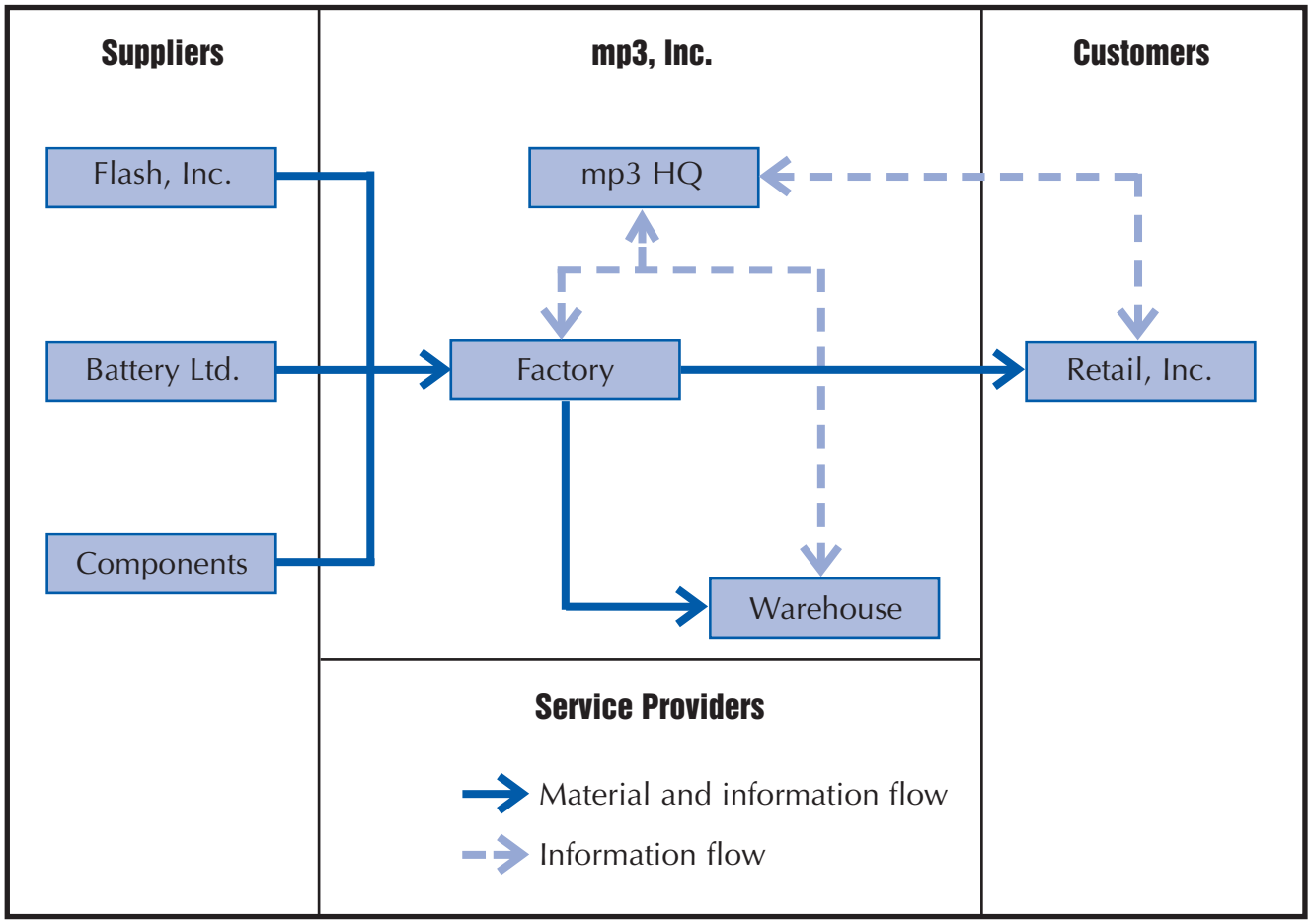
- Business Scope diagram: Set the scope for a project or organization
- Geographic Map (a.k.a.Geo Map): Describes material flows in a geographic context; Highlights node* complexity or redundancy
- Thread Diagram: Material flow diagram, focused on level 2 process connectivity; Describes high level process complexity or redundancy
- Workflow or Process Models: Information, material and work flow diagram at level 3 (or beyond); Highlights information, people and system interaction issues

* A node represents a logical or geographic entity in a supply chain.
Examples: Warehouse, Factory, Store

Steps to Create a Business Scope Diagram

1. Create or open the business scope diagram template
2. Identify customers of your organization or project and enter these in the customers column in the scope diagram.
3. Identify and enter the key nodes within your organization or project. A node represents a logical or geographic entity in the supply chain. Consider: Warehouse, Factory, Store, HQ etc.
4. Identify and enter the suppliers of your organization or project
5. Optionally link the nodes to reflect material and/or information flows. Use a different color and/or stroke differentiate material and information flows.

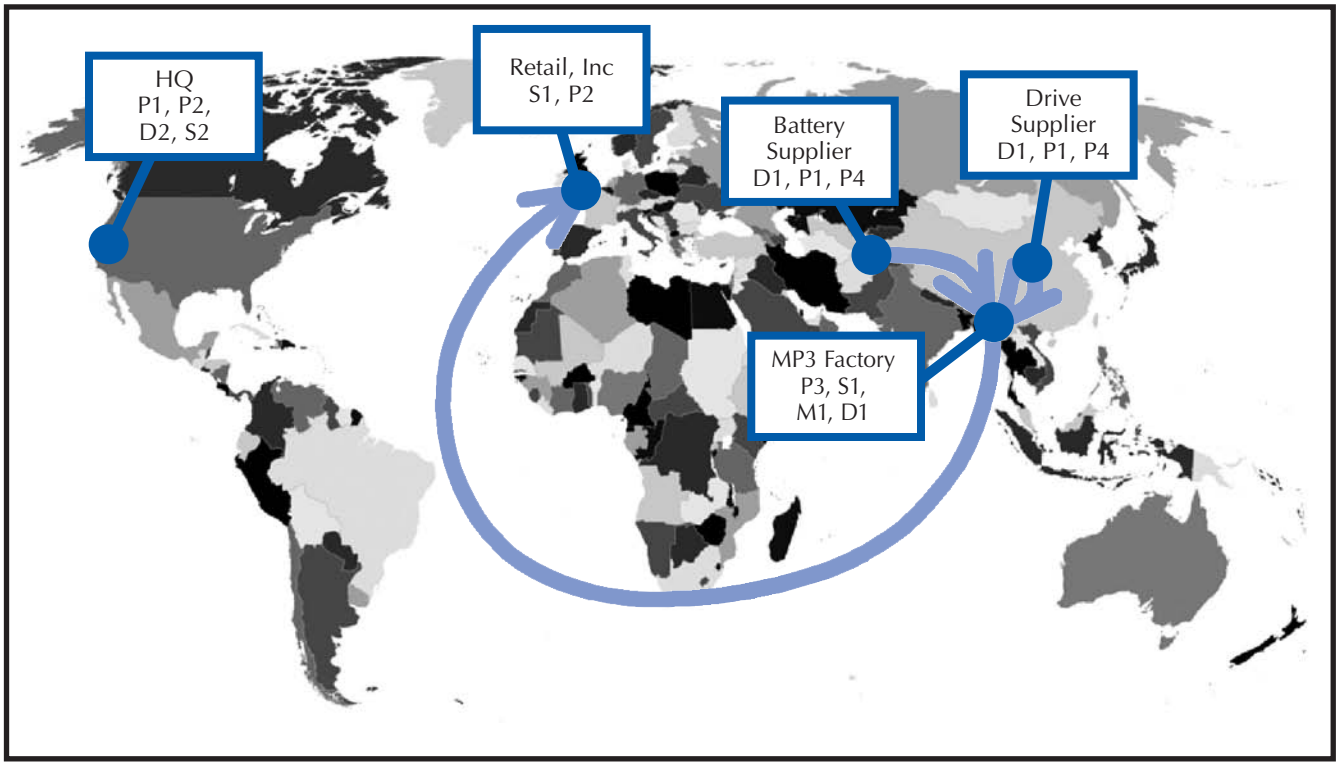
Example:



Steps to Create a Geographic Map:

1. Create geographic context (a.k.a. the map)
2. Draw and name your customers on the map
   - **a.** Identify the level 2 processes
   - **b.** List the level 2 processes in the customer on your map
3. Beginning with your customers, repeat this for every node on the map:
   - **a.** Identify all supplying nodes (where does material come from)
   - **b.** Draw and name these supplying nodes on the map
   - **c.** Identify the level 2 processes
   - **d.** list these in the node on your map
   - **e.** Draw the material flows (arrows connecting the nodes)
4. Repeat until you have included all your suppliers/nodes

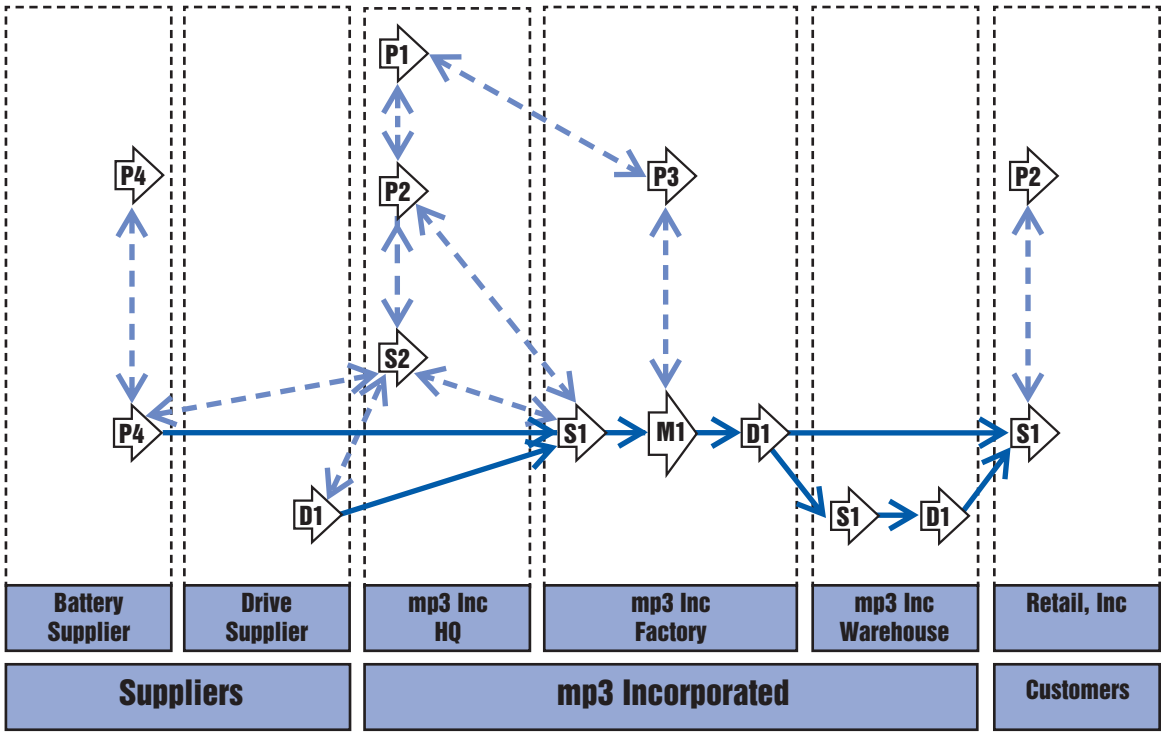
Example:



Steps to Create a SCOR Thread Diagram:

1. Create or open the thread diagram template
2. Repeat these steps for every relevant node on the geographic map:
   a. Determine the class of the node (Customer, Supplier, etc) and create a column (node) in the appropriate class
   b. Create process representations for each process listed in the column for this node (D2, M2, S1, etc)
   c. Create process representations for each process listed in the column for this node (D2, M2, S1, etc)
   d. Link the processes to the previous node's processes (partially using the material flow information from the Geographic Map)
3. Repeat until all relevant nodes have been created
4. Optionally add information flows (using different color/stroke)

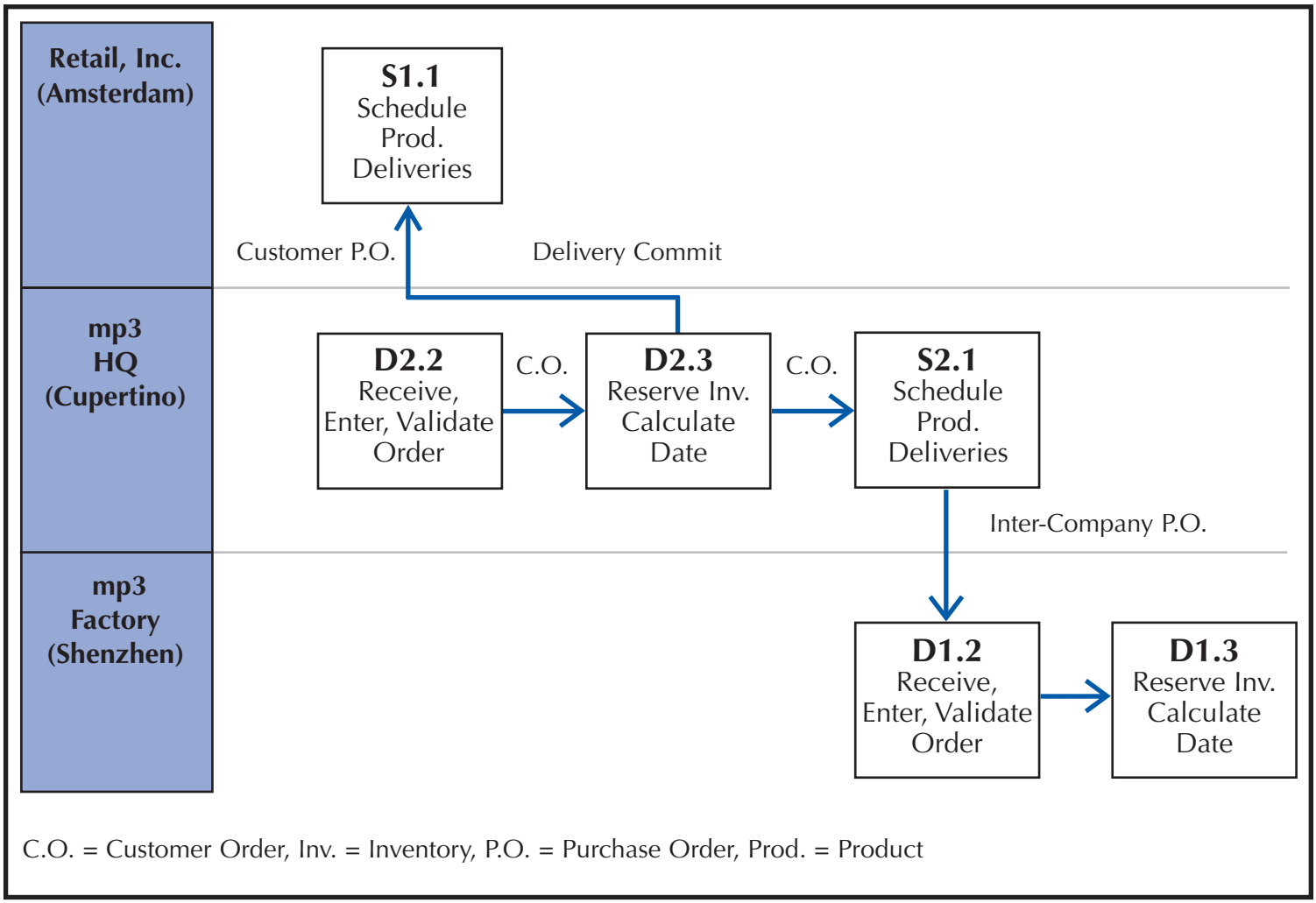
Example:



Steps to Establish SCOR Process Models (Workflows)

1. Obtain generic descriptions (this is what people describe)
2. Map these generic descriptions to SCOR process IDs (normalize)
3. Create swimming lanes to reflect organizational boundaries
4. Create workflow with these SCOR processes
5. Add description to workflows to reflect inputs/outputs of the processes
6. Optionally add other relevant information

Example:



C.O. = Customer Order, Inv. = Inventory, P.O. = Purchase Order, Prod. = Product

Next steps to learn

Attend Supply-Chain Council Trainings Scheduled Globally.
VISIT **www.supply-chain.org** to find the latest training schedule.

Notes

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SCOR® Supply-Chain Council

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