Supply Chain Operations Reference Model Version 7.0

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Supply Chain Operations Reference-model (SCOR) 7.0

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Introduction

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.

The SCC was organized in 1996 and initially included 69 practitioner companies meeting in an informal consortium. Subsequently, the companies of the Council elected to form an independent not for profit trade association. The majority of the SCC's members are practitioners and represent a broad cross-section of industries, including manufacturers, distributors, and retailers. Equally important to the Council and the advancement of the SCOR-model are the technology suppliers and implementers, the academicians, and the government organizations that participate in Council activities and the development and maintenance of the Model. At the time of this release, the Council has approximately 800 members worldwide and has established international chapters in Australia/New Zealand, Brazil, Greater China, Europe, Japan, Southeast Asia, and Southern Africa with additional requests for regional chapters pending.

The Supply-Chain Council is interested in providing the widest possible dissemination of the SCOR-model. The wide-spread use of the Model results in better customer-supplier relationships, software systems that can better support members through the use of common measurements and terms, and the ability to rapidly recognize and adopt best practice no matter where it originates. SCC requests that all who use the SCOR-model provide attribution to the Supply-Chain Council. Additionally, members are encouraged to monitor the members section of the SCC website (www.supply-chain.org) to ensure that they are using the latest version of SCOR.

This introduction is provided to assist new users of the SCOR-model to begin analytic and implementation projects. It is intended to remind experienced users of the framework and structure of the Model to assist in more complex applications and operationalizing the Model for their businesses. Finally, it is provided to orient members to the changes between Version 7.0 and Version 6.1.

Version 7.0 of the SCOR-model is the ninth revision since the Model's introduction in 1996. Revisions of the Model are made when it is determined by Council members that changes should be made to facilitate the use of the Model in practice. **In Version 7.0, there are two primary areas of change.**

Significant effort continues to be made to make the application of metrics within the Model easier for SCOR practitioners. In this version of the Model, Level 1 Metrics have been re-defined and their underlying structure has been made more explicit. Those who have previously used the Model will observe that the number of Level 1 metrics has declined. That is not to say that metrics that have been identified as Level 1 in previous versions of the Model have been removed from the SCOR-model. Rather, most Level 1 metrics that do not appear as Level 1 in this version have been "demoted" to lower level metrics, but still remain within the Model. As part of this restructuring of the metrics, Deliver processes required change. The Level 3 processes in the Deliver activities were expanded to more closely align with cycle time and cost metrics. A new metrics section has been included, as an appendix, which will describe the metrics, its calculation, and its impact in more detail than has been previously provided. Version 7.0 of the Model includes the Level 1 metrics in the appendix; subsequent versions are expected to include all metrics in the appendix.

The second major area of change in this version of the Model is the addition of a number of best practices (12 – four of these were listed, but not detailed, in Version 6.1) and an appendix, which defines and discusses the best practices in considerable detail. Version 7.0 includes the best practices that are being introduced or re-defined in this version. Subsequent versions of the Model are expected to include all of the best practices in the appendix.

Scope

The SCOR-model has been developed to describe the business activities associated with all phases of satisfying a customer's demand. The Model itself contains several sections and is organized around the five primary management processes of Plan, Source, Make, Deliver, and Return (shown in **Figure 1)**. By describing supply chains using these process building blocks, the Model can be used to describe supply chains that are very simple or very complex using a common set of definitions. As a result, disparate industries can be linked to describe the depth and breadth of virtually any supply chain. The Model has been able to successfully describe and provide a basis for supply chain improvement for global projects as well as site-specific projects.

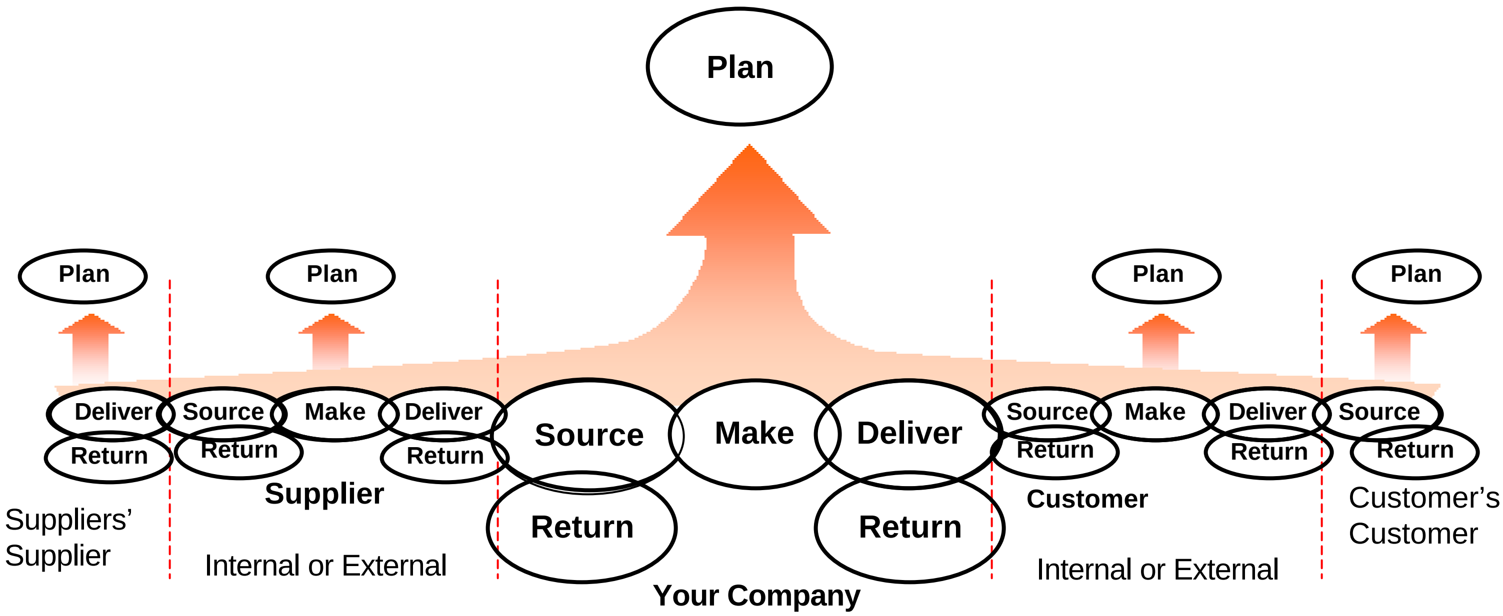


Figure 1 - SCOR is organized around five major management processes.

It spans: all customer interactions (order entry through paid invoice), all physical material transactions (supplier's supplier to customer's customer, including equipment, supplies, spare parts, bulk product, software, etc.) and all market interactions (from the understanding of aggregate demand to the fulfillment of each order). It does not attempt to describe every business process or activity. Specifically, the Model does not address: sales and marketing (demand generation), product development, research and development, and some elements of post-delivery customer support.

It should be noted that the scope of the Model has changed and is anticipated to change based on Council member requirements. With the introduction of Return, the Model has been extended into the area of post-delivery customer support (although it does not include all activities in that area).

As shown in **Figure 2**, the Model is designed and maintained to support supply chains of various complexities and across multiple industries. The Council has focused on three process levels and does not attempt to prescribe how a particular organization should conduct its business or tailor its systems / information flow. Every organization that implements supply chain improvements using the SCOR-model will need to extend the Model, at least to Level 4, using organization-specific processes, systems, and practice.

The Model is silent in the areas of human resources, training, and quality assurance among others. Currently, it is the position of the Council that these horizontal activities are implicit in the Model and there are other highly qualified organizations that are chiefly concerned with how an organization should train, retain, organize, and conduct their quality programs. Just as the Council recognized the requirements for marketing and sales in commercial organizations, the Council is not minimizing the importance of these other activities.

SCOR Contains Three Levels of Process Detail

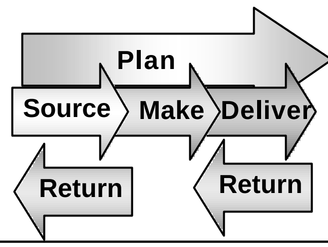
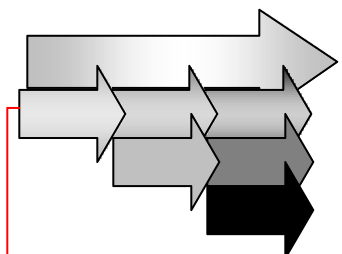
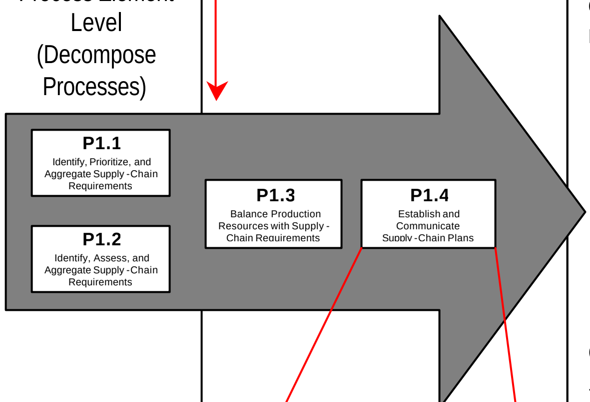
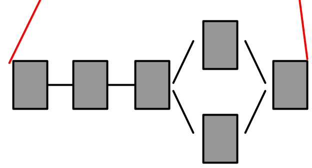
	Level			
	#	**Description**	**Schematic**	**Comments**
Supply-Chain Operations Reference-model	1	Top Level (Process Types)		Level 1 defines the scope and content for the Supply chain Operations Reference-model. Here basis of competition performance targets are set.
	2	Configuration Level (Process Categories)		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 • Best practices, where applicable • System capabilities required to support best practices • Systems/tools Companies "fine tune" their Operations Strategy at Level 3.
Not in Scope	4	Implementation Level (Decompose Process Elements)		Companies implement specific supply-chain management practices at this level. Level 4 defines practices to achieve competitive advantage and to adapt to changing business conditions.

Figure 2 - SCOR is a hierarchical model with specific boundaries in regard to scope.

The SCOR-model is a business process reference model as illustrated in **Figure 3**. That is, it is a Model that links process elements, metrics, best practice and the features associated with the execution of a supply chain in a unique format. The uniqueness and power of the Model and its successful implementation is chiefly derived from using these four elements together.

It is important to note that this Model describes processes not functions. In other words, the Model focuses on the activity involved, not the person or organizational element that performs the activity.

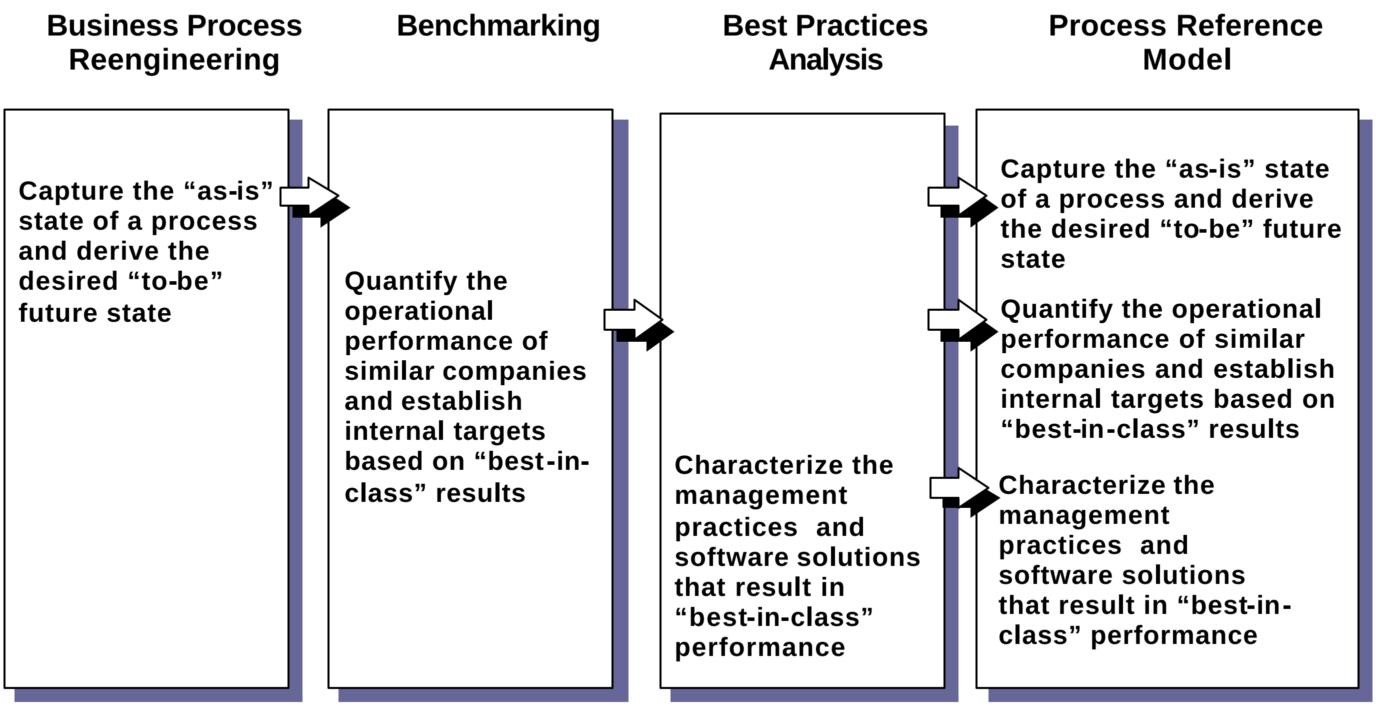


Figure 3 - SCOR is a business process reference model.

SCOR-model Structure

Besides the five basic management processes (Plan, Source, Make, Deliver, Return) that provide the organizational structure of the SCOR-model, it is useful to distinguish between the three process types in the Model: planning, execution, and enable (formerly infrastructure). A planning element is a process that aligns expected resources to meet expected demand requirements. Planning processes balance aggregated demand across a consistent planning horizon. Planning processes generally occur at regular intervals and can contribute to supply chain response time. Execution processes are triggered by planned or actual demand that changes the state of products. They include scheduling and sequencing, transforming materials and services, and moving product. Enable processes prepare, maintain, and manage information or relationships upon which planning and execution processes rely.

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. 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 Planning element).

As indicated in **Figure 2**, the Model is hierarchical with three levels. P1.1 is a notation that indicates a third level process element. In this case, it is a Plan (P – Level 1) element that is concerned with supply chain planning (1 – Level 2) and is specific to identifying, prioritizing, and aggregating supply chain requirements (.1 – Level 3).

The SCOR-model contains 8 basic sections: Introduction, Plan, Source, Make, Deliver, Return, Glossary and Appendices. For modeling purposes, Return is documented in two locations – Source and Deliver. Those Return processes that connect an organization with its supplier (i.e., the return of raw material) are documented as Source Return activities. Those processes that connect an organization with its customer (i.e. the receipt of returned finished goods) are documented as Deliver Return activities. This preserves the concept that Source connects an organization with its suppliers and Deliver connects an organization with its customers. The Plan and Execution (Source, Make, Deliver, Return) sections are the heart of the Model while the Glossary provides a listing of the standard process and metrics terms that are used within the Model. The Appendices provide detailed information on metrics and best practices.

Plan, Source, Make, Deliver, and Return sections are organized with a standard structure. At the beginning of each section, there are graphics that provide a visual representation of the process elements, their relationships to each other, and the inputs and outputs that are germane to each process element. Following the graphics are text tables that identify: 1) the standard name for the process element, 2) the notation for the process element, 3) SCC's "standard" definition for the process element, 4) performance attributes that are associated with the process element, 5) metrics that are associated with the performance attributes, 6) best practices that are associated with the process (candidates, not necessarily an exhaustive list), and features (generally technologically related) that can contribute to heightened performance of the process.

Within the Source, Make and Deliver process elements, a common internal structure has been agreed upon. The Model focuses on three environments, Make-to-Stock, Make-to-Order, and Engineer-to-Order. As a result, S1 becomes Source Make-to-Stock Product, S2 becomes Source Make-to-Order Product and S3 becomes Source Engineer-to-Order Product. This same convention is used for Make, i.e. M1 – Make-to-Stock, and Deliver, i.e. D2 – Deliver Make-to-Order Product. This convention was extended to Return in Version 5.0. R1 is the Return of Defective Product, R2 is the Return of Maintenance, Repair or Overhaul (MRO) Product, and R3 is the Return of Excess Product.

Within each of the planning and execution sections and following the graphic and text descriptions, the associated Enable elements are described using the same graphic and text formats.

It is important to note, that like the process elements themselves, the metrics are intended to be hierarchical. Although not explicit in the Model, Level 1 metrics, as shown in **Figure 4** are typically "assigned" to P1 (Plan Supply Chain) and are decomposed (Level 2 and diagnostic metrics) to the respective planning, execution and enable elements.

Performance Attributes and Level 1 Metrics

Level 1 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	
	Reliability	Responsiveness	Flexibility	Costs	Assets
Perfect Order Fulfillment	X				
Order Fulfillment Cycle Time		X			
Upside Supply Chain Flexibility			X		
Upside Supply Chain Adaptability			X		
Downside Supply Chain Adaptability			X		
Supply Chain Management Cost				X	
Cost of Goods Sold				X	
Cash-To-Cash Cycle Time					X
Return on Supply Chain Fixed Assets					X

Figure 4 - SCOR Performance Attributes and Level 1 Metrics

The metrics are used in conjunction with performance attributes. In Version 4.0 of the Model, the Performance Attributes were expanded from four (Supply Chain Reliability, Supply Chain Flexibility and Responsiveness, Supply Chain Costs, and Supply Chain Asset Management) to five (Supply Chain Reliability, Supply Chain Responsiveness, Supply Chain Flexibility, Supply Chain Costs, and Supply Chain Asset Management). Generally, the impact of this exercise was to associate cycle time measures with Responsiveness and to identify needed metrics in the area of Flexibility. The table in **Figure 5** defines the performance attributes and indicates which Level 1 metrics are associated with each attribute.

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.

Performance Attributes and Associated Level 1 Metrics

Performance Attribute	Performance Attribute Definition	Level 1 Metric
Supply Chain Reliability	The performance of the supply chain in delivering: the correct product, to the correct place, at the correct time, in the correct condition and packaging, in the correct quantity, with the correct documentation, to the correct customer.	Perfect Order Fulfillment
Supply Chain Responsiveness	The speed at which a supply chain provides products to the customer.	Order Fulfillment Cycle Time
Supply Chain Flexibility	The agility of a supply chain in responding to marketplace changes to gain or maintain competitive advantage.	Upside Supply Chain Flexibility
		Upside Supply Chain Adaptability
		Downside Supply Chain Adaptability
Supply Chain Costs	The costs associated with operating the supply chain.	Supply Chain Management Cost
		Cost of Goods Sold
Supply Chain Asset Management	The effectiveness of an organization in managing assets to support demand satisfaction. This includes the management of all assets: fixed and working capital.	Cash-to-Cash Cycle Time
		Return on Supply Chain Fixed Assets

Figure 5 – Definitions for SCOR Performance Attributes and which Level 1 metrics are associated with each attribute.

Associated with the Performance Attributes are the Level 1 Metrics. These Level 1 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. While these Performance Attributes are critical in implementing the Model, formal definitions were not previously included in the Model. In Version 4.0, standard Performance Attribute definitions were provided. In Version 5.0, the process tables associated with Level 2 and 3 activities were reconciled to reflect the separation of the flexibility and responsiveness attributes and to ensure that the metrics measured what they were intended to measure.

First time users of the Model should be aware that the metrics in the Model are hierarchical – just as the process elements are hierarchical. Level 1 Metrics are created from lower level calculations. (Level 1 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).

Lower level calculations (Level 2 metrics) are generally associated with a narrower subset of processes. For example, Delivery Performance is calculated as the total number of products delivered on time and in full based on a commit date. Additionally, even lower level metrics (diagnostics) are used to diagnose variations in performance against plan. For example, an organization may wish to examine the correlation between the request date and commit date.

SCOR Version 7.0 Changes

There are a number of major changes within Version 7.0. This section will highlight those changes.

Process Changes

Deliver

While the majority of the changes in Version 7.0 focus on metrics and best practice, there are changes to the process elements of the Model as well. The most significant of these changes is the modification of existing Deliver Level 3 process elements and the addition of Deliver Level 3 process in D1, D2, and D3. Specifically, the processes associated with pick, pack, load, and ship have been identified as four unique processes in Version 7.0. Previously these processes were identified as two processes (pick - load and ship). This change has been driven by a desire to better capture the time and cost associated with the processes at the lower levels.

Best Practice

A significant initiative within the Supply Chain Council technical community involves updating the Best Practices within the Model. Version 7.0 continues the introduction of new and modified Best Practices and an expansion of existing Best Practices. Central to this initiative has been the introduction of an objective definition of a best practice (contained in the glossary). Version 7.0 offers the following definition of a Best Practice: *A current, structured, proven and repeatable method for making a positive impact on desired operational results*. This definition is being used to identify "new" best practices (best practices not currently documented in the Model) and to validate best practices that are currently in the Model.

Consistent with the Model's existing structure, best practices are documented within the applicable process tables and are defined within the glossary. Recognizing that the glossary provided a definition but did little in understanding how to apply the best practice, the Council has begun to more exhaustively describe the Best Practices in an appendix. It is anticipated that all Best Practices will be included within the appendix, but in this Version, 12 have been selected as a representative set to develop the appendix. The following Best Practices are included in the Version 7.0 appendix:

- **Co-Located Procurement Representatives**
- **Cross-Docking**
- **Drum – Buffer – Rope Scheduling Technique**
- **Environmental Performance Indicator module (EPI module)**
- **Inventory Cycle Counting**
- **Merge-In-Transit**
- **Vendor Managed Inventory (VMI)**
- **Wave Picking**
- **Assess Supplier Performance**
- **Collaborative Planning, Forecasting, Replenishment (CPFR)**
- **Sales and Operations Planning**
- **Supplier (Carrier) Agreements**

It is anticipated that the next release of the Model will significantly expand the best practices within the Model and the appendix.

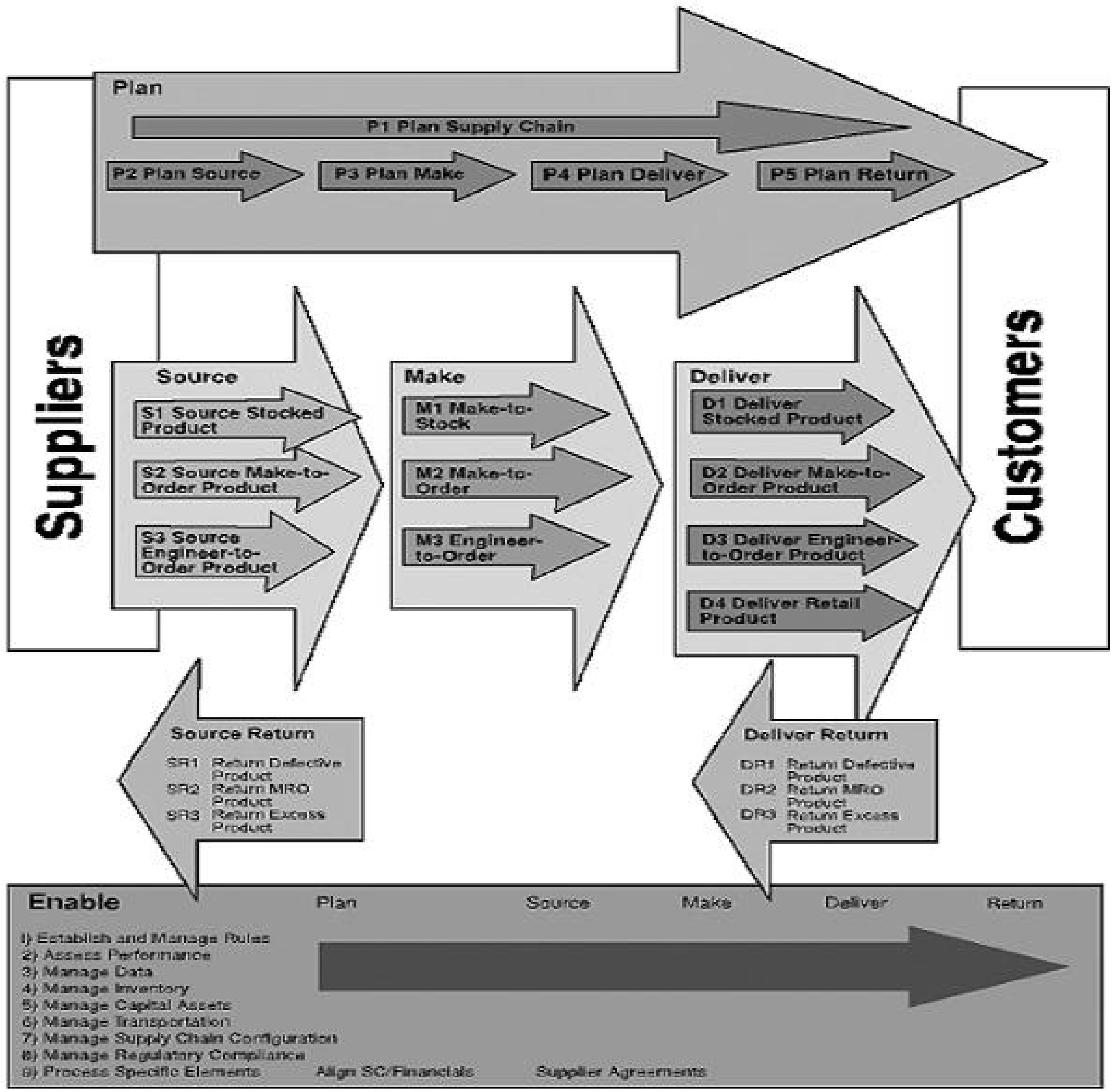
Metrics

A continuing effort within the Supply Chain Council technical community involves improving the Metrics and making them easier to use by first-time SCOR Model users and practitioners that have been using the Model for years. This effort led to the definition of Performance Attributes in Version 4.0. In Version 7.0 of the Model, Level 1 Metrics have been re-defined and an attempt has been made to make their underlying structure more explicit. As a result, the number of Level 1 Metrics has decreased and some metrics that were previously Level 1 Metrics have been identified as lower level Metrics.

Additionally, as the Level 1 Metrics have been defined, Level 2 and at times Level 3 metrics have been identified. The new definitions are included in the glossary and process tables have been updated to include a reference to all of the metrics identified. Because Level 1 metrics are calculated from lower level components, this re-definition has required that the majority of Model's process tables have been changed in the metrics section.

New metrics definitions are provided in the metrics section of the glossary but recognizing that the glossary did little in understanding how to apply the metric, the Council has begun to more exhaustively describe the Metrics in an appendix. It is anticipated that all Metrics will be included within the appendix, but in this Version the Level 1 metrics, only, have been selected as a representative set to develop the appendix.

SCOR Toolkit



The Technical Change Process

The SCOR-model is developed and maintained by the voluntary efforts of the Supply Chain Council members. Unlike other organizations with large technical staffs, the Council depends on the contributions of its members to actively advance the state of knowledge in supply chain by identifying required Model changes, researching and validating those changes, and developing the consensus regarding the proposed changes. SCOR-model versions prior to Version 6.0 were developed in a Committee structure that was focused on developing a stable, usable Model that could be used by experienced Council members as well as organizations newly introduced to the SCOR concept. In 2002, confident that the Model's stability had been demonstrated with over 5 years of application experience by Council members, the Supply Chain Council shifted its technical development focus to specific implementation issues.

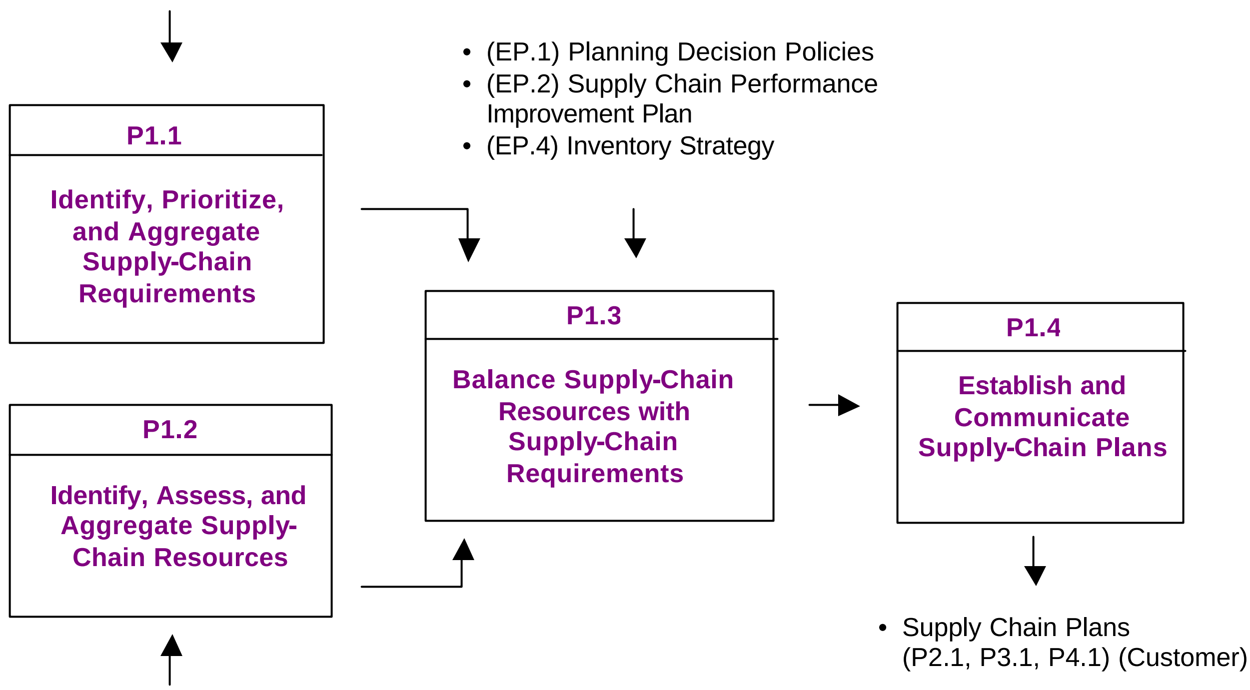
The current technical development process relies on project teams composed of volunteers from Supply Chain Council member organizations. These project teams are short-lived groups that focus on specific Model challenges. It is expected that the normal term of a project team will be between 3-6 months. The change process and the coordination of the project team activities is led by the Technical Development Steering Committee (TDSC), a standing body elected by their peers in the Council. Changes to the Model are normally initiated by a Council member or members (but may be initiated by a Special Industry Group, an implementation project team, or the Chief Technical Officer). The primary mechanism for changing the Model is the Project Team. These self-organizing and self-directed teams propose areas of investigation, pursue and develop proposals for Model development and publish research results on the Council website. These activities are coordinated by the Supply Chain Council's Technical Development Steering Committee, which is comprised of elected representatives from the Council's membership.

The Model change process is documented on the SCC's website. Essentially, the process consists of: 1) The Council issues a call for volunteers to work on an identified need for revision or change, 2) volunteers submit a Charter Proposal to the TDSC outlining the concept, scope of work, schedules and milestones, and identifying the volunteer resources, 3) the TDSC reviews the proposed Charter and provides feedback on the proposed changes to the initiating group, 4) upon approval, the Project Team crafts the details of their scope of work and determines whether it is likely their efforts will lead to a Model change (which generally includes the modification of SCOR processes, metrics, best practice, features and inputs and outputs) or a research report (white paper), 5) the Project Team proposes how to integrate proposed changes into the overall Model, 6) after final technical review the TDSC forwards the technical community recommendations for proposed changes/additions to the SCC Board of Directors, and 7) following the approval of the Board, the new Model is published for the SCC membership.

PLAN

P1: Plan Supply Chain

- (Customer) Customer Requirements
- (D1.3) Order Backlog
- D1.11, D2.11, D3.11) Shipments
- (EP.3) Planning Data
- (EP.9) Revised Aggregate Forecast and Projections, Revised Business Assumptions



- (P2.4) Sourcing Plans
- (P3.4) Product MAKE Plans
- (P4.4) Delivery Plans
- (EP.3) Planning Data
- (EP.5, EP.6) Projected Internal and External Production Capacity
- (EP.5, EP.6) Revised Capital Plan
- (EP.5, EP.6) Outsource Plan
- (EP.8) Regulatory Requirements
- (Customer) Inventory

Process Category: Plan Supply Chain	Process Number: P1
Process Category Definition	
The development and establishment of courses of action over specified time periods that represent a projected appropriation of supply chain resources to meet supply chain requirements.	
Performance Attributes	**Metric**
Reliability	Perfect Order Fulfillment
Responsiveness	Order Fulfillment Cycle Time
Flexibility	Upside Supply Chain Flexibility Downside Supply Chain Adaptability Upside Supply Chain Adaptability
Cost	Supply Chain Management Costs Cost of Goods Sold
Assets	Cash-to-Cash Cycle Time Return on Supply Chain Fixed Assets
Best Practices	**Features**
Supply/demand process is highly integrated from customer data gathering to order receipt, through production to supplier request	Integrated supply chain planning system with interfaces to all supply/demand data sources through public and private digitally enabled supply networks.
Re-balancing of full-stream supply/demand on a daily basis, including Source-Make-Deliver resources and requirements from “customers' customer to suppliers' supplier”	Enterprise-wide planning system Customer Relationship Systems
Capability to run “simulated” full-stream supply/demand balancing for “what-if” scenarios	Supply chain modeling and visualization system
A change in the demand signal instantaneously “reconfigures” the production and supply plans	Event-driven supply chain re-planning
Responsiveness and flexibility are emphasized by developing expertise in making business processes re-programmable, re-configurable and continuously changeable	Integrated process modeling and software reconfiguration tools
Supply chain is designed to have supply flexibility equal to demand volatility	None Identified
On-line visibility of all supply-chain demand requirements and resources, both currently available and committed (pegged)	Enterprise resource planning system Customer relationship management system
Tools support balanced decision making (e.g., trade-off between service level and inventory investment)	Supply chain planning optimization system
All functions and organizations understand their impact on supply/demand balancing, including sales, marketing, product management, manufacturing, customer, suppliers, materials management, and product development	None Identified
CPFR®, Collaborative Planning, Forecasting, Replenishment	See Glossary
S&OP, Sales and Operations Planning	See Glossary
Co-located Procurement Representatives	See Glossary
Vendor Managed Inventory (VMI)	See Glossary

Process Element: Identify, Prioritize and Aggregate Supply Chain Requirements	Process Element Number: P1.1
Process Category Definition	
The process of identifying, aggregating, and prioritizing, all sources of demand for the integrated supply chain of a product or service at the appropriate level, horizon and interval. The sales forecast is comprised of the following concepts: sales forecasting level, time horizon, and time interval. The sales forecasting level is the focal point in the corporate hierarchy where the forecast is needed at the most generic level. i.e. Corporate forecast, Divisional forecast, Product Line forecast, SKU, SKU by Location. The sales forecasting time horizon generally coincides with the time frame of the plan for which it was developed i.e. Annual, 1-5 years, 1- 6 months, Daily, Weekly, Monthly. The sales forecasting time interval generally coincides with how often the plan is updated, i.e. Daily, Weekly, Monthly, and Quarterly.	
Performance Attributes	**Metric**
Reliability	Forecast Accuracy
Responsiveness	None Identified
Flexibility	None Identified
Cost	None Identified
Assets	None Identified
Best Practices	**Features**
Collaboration among Supply Chain partners extends outwards to customers, spanning the supply chain. Planning Replanning Business Rules Plan Changes	None Identified
Collaboration among Operations Strategy Team	Supply Chain Advanced Planning Systems Supply Chain Integration Systems Integration between supply chain advanced planning and ERP execution systems Supply Chain Capacity Planning Systems B2B Integration and Application Server Systems
Digital links (XML Based, EDI. Etc.) among supply chain members.	Real-time exchange of supply chain information between supply chain members Collaborative planning systems, Internet Trading Exchanges, B2B Integration and Application Server Systems
Joint Service Agreements (JSA)	Collaborative Planning Systems
“Push-based” forecasts are replaced with customer replenishment “pull-based” signals	Standards Based (RosettaNet, eBXML, OAGI, etc) B2B integration tools and systems
Systems support accurate on-line visibility of full-stream demand requirements and priorities	Advance Planning and Scheduling System Supply Chain Event Management Software

Inputs	Plan	Source	Make	Deliver	Return
(Customer) Customer Requirements					
Order Backlog, Shipments				D1.3, D1.10	
Planning Data	EP.3				
Revised Aggregate Forecast and Projections, Revised Business Assumptions	EP.9				

Outputs	Plan	Source	Make	Deliver	Return

Process Element: Identify, Prioritize and Aggregate Supply Chain Resources	Process Element Number: P1.2
Process Category Definition	
The process of identifying, prioritizing, and aggregating, as a whole with constituent parts, all sources of supply that are required and add value in the supply chain of a product or service at the appropriate level, horizon and interval.	
Performance Attributes	**Metric**
Reliability	None identified
Responsiveness	None Identified
Flexibility	None Identified
Cost	Planning Costs as a % of Total Supply Chain Management Costs Product Data (MIS) Management Costs
Assets	Inventory Days of Supply Inventory Turns
Best Practices	**Features**
Collaborative Planning, Forecasting and Replenishment (CPFR)	Business process modeling Workflow systems Collaboration Tools Advanced Planning Optimization Constraint based planning Integrated resource and material plan B2B Integration and Application Server Systems
Joint Service Agreements (JSA)	Collaborative Planning Systems
Digital links (Internet, EDI. Etc.) among supply chain members.	Real-time exchange of supply chain information between supply chain members Collaborative planning systems, Internet Trading Exchanges.
Lead times updated monthly.	None Identified
Categorize 100% of total inventory (active, usable, excess, obsolete) for appropriate action.	None Identified
Review product profitability.	ABC and cost modeling.

Inputs	Plan	Source	Make	Deliver	Return
(Customer) Inventory					
Sourcing Plans	P2.4				
Product MAKE Plans	P3.4				
Delivery Plans	P4.4				
Planning Data	EP.3				
Projected Internal and External Production Capacity	EP.5, EP.6				
Revised Capital Plan	EP.5, EP.6				
Outsource Plan	EP.5, EP.6				
Regulatory Requirements	EP.8				

Outputs	Plan	Source	Make	Deliver	Return

Process Element: Balance Supply-Chain Resources with Supply-Chain Requirements	Process Element Number: P1.3
Process Category Definition	
The process of identifying and measuring the gaps and imbalances between demand and resources in order to determine how to best resolve the variances through marketing, pricing, packaging, warehousing, outsource plans or some other action that will optimize service, flexibility, costs, assets, (or other supply chain inconsistencies) in an iterative and collaborative environment.	
Performance Attributes	**Metric**
Reliability	Delivery Performance to Customer Commit Date Fill Rate
Responsiveness	None Identified
Flexibility	None Identified
Cost	None Identified
Assets	Inventory Days of Supply Asset Turns
Best Practices	**Features**
Demand Planning, Demand Flow Leadership	Software that provides multiple data models including the business rules and metrics for the entire supply chain planning process. Algorithms use the business rules and metrics as the drivers for the planning engine.
Collaborative Planning, Forecasting and Replenishment (CPFR)	Supply chain planning systems and communication technologies as well as newly defined standards that reflect the CPFR model and 'participate' in the entire planning process.
Business Intelligence (BI)	A data warehouse / data mart is the source of all planning (master) data, business rules and transaction data. Analytical tools enable the ongoing maintenance and improvement of the business rules based on actual data.
Customer Relationship Management (CRM)	Software that provides customer input and keeps the customer informed about the planning of the production and delivery process by managing all contacts and communication with the customer thorough all channels including internet and traditional sales and customer service channels.

Inputs	Plan	Source	Make	Deliver	Return
Planning Decision Policies	EP.1				
Supply Chain Performance Improvement Plan	EP.2				
Inventory Strategy	EP.4				

Outputs	Plan	Source	Make	Deliver	Return

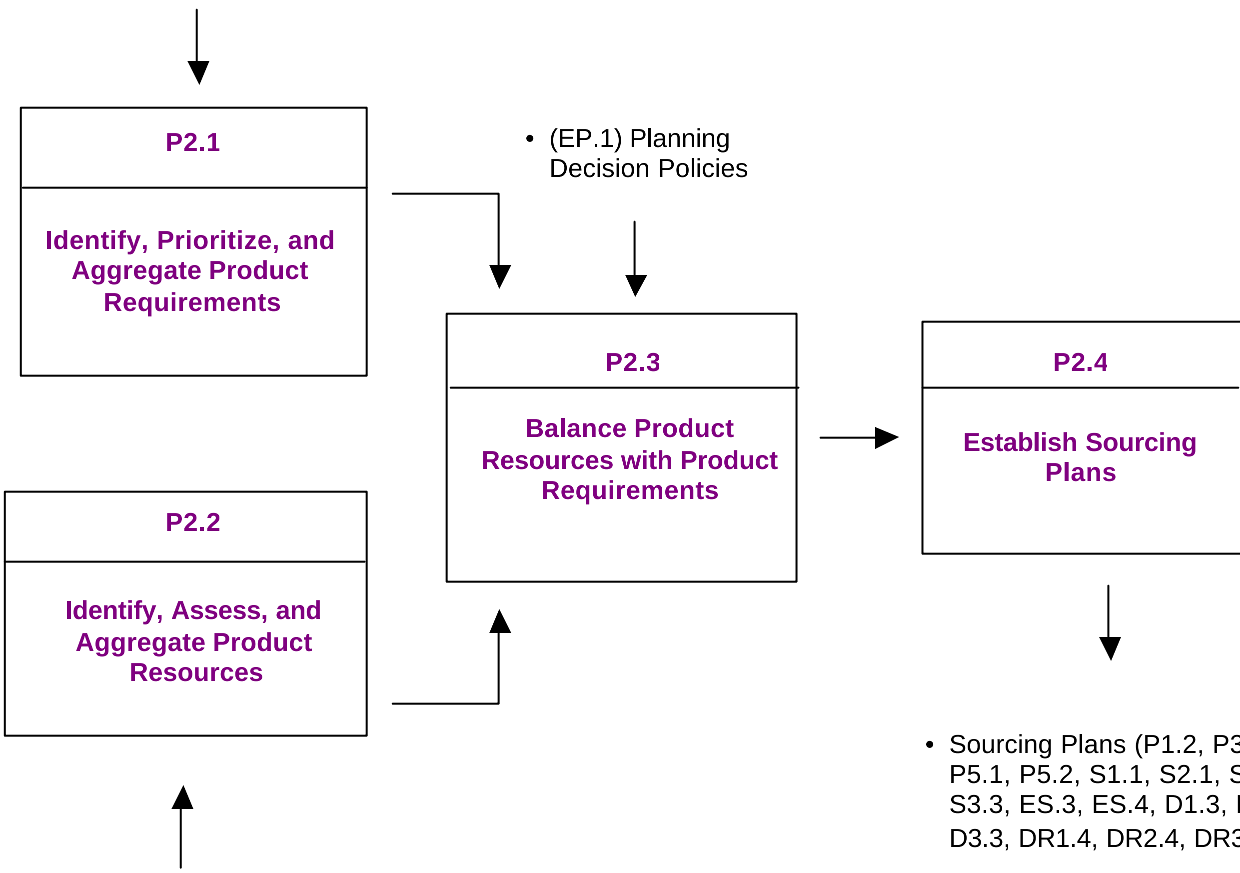
Process Element: Establish and Communicate Supply Chain Plans	**Process Element Number: P1.4**
Process Element Definition	
The establishment and communication of courses of action over the appropriate time-defined (long-term, annual, monthly, weekly) planning horizon and interval, representing a projected appropriation of supply-chain resources to meet supply-chain requirements.	
Performance Attributes	**Metric**
Reliability	On-time Delivery
Responsiveness	None Identified
Flexibility	None Identified
Cost	None Identified
Assets	Inventory Days of Supply
Best Practices	**Features**
Collaboration among Supply Chain partners extends outwards to suppliers and customers, spanning the supply chain. Planning Replanning Business Rules Plan Changes	Supply Chain Advanced Planning Systems Supply Chain Integration Systems Integration between supply chain Advanced Planning and ERP execution systems Supply Chain Capacity Planning Systems
Collaboration among Operations Strategy Team	Supply Chain Advanced Planning Systems Supply Chain Integration Systems Integration between supply chain advanced planning and ERP execution systems Supply Chain Capacity Planning Systems
Joint Service Agreements (JSA)	Collaborative Planning Systems
Digital links (Internet, EDI. Etc.) connecting (or between) supply chain members.	Real-time exchange of supply chain information between supply chain members *Collaborative planning systems, Internet Trading Exchanges.*
Systems support accurate on-line visibility of full-stream demand requirements and priorities as well as resource utilization and availability.	Advance Planning and Scheduling System

Inputs	**Plan**	**Source**	**Make**	**Deliver**	**Return**

Outputs	**Plan**	**Source**	**Make**	**Deliver**	**Return**
Supply Chain Plans (Customer)	P2.1, P3.1, P4.1				

P2: Plan Source

- (P1.4) Establish and Communicate Supply Chain Plans
- (P3.4) Production Plans
- (P4.4) Delivery Plans
- (P5.4) Source Return Requirements
- (EP.3) Planning Data
- (EP.7) Item Master, Bill of Materials, Product Routings
- (D2.3, D3.3) Order Signal



- Sourcing Plans (P1.2, P3.2, P4.2, P5.1, P5.2, S1.1, S2.1, S3.1, S3.3, ES.3, ES.4, D1.3, D2.3, D3.3, DR1.4, DR2.4, DR3.4)

- (Supplier) Product Availability
- (S1.4, S2.4, S3.6) Inventory Availability
- (S1.1, S2.1, S3.3) Sourced Product on Order
- (EP.3) Planning Data
- (ES.4) Product Inventory Targets

Process Category: Plan Source	Process Number: P2
Process Category Definition	
The development and establishment of courses of action over specified time periods that represent a projected appropriation of material resources to meet supply chain requirements.	
Performance Attributes	**Metric**
Reliability	Perfect Order Fulfillment
Responsiveness	None Identified
Flexibility	Upside Source Flexibility Downside Source Adaptability Upside Source Adaptability
Cost	Total Source Costs % of (S+M+D) Costs
Assets	Cash to Cash Cycle Time Return on Supply Chain Fixed Assets
Best Practices	**Features**
EDI links integrate supplier resource information (inventory, capacity availability, etc.) with own resources	Inter-company resource planning with EDI/Internet communication
Joint Service Agreements with suppliers define the levels of "flexibility" or resource upside available within stated lead times and agreed upon conditions	None Identified
Distinct and consistent linkages exist to ensure disruptions and opportunities in material resources are quickly and accurately communicated and acted upon	Bi-directional Digital Links (XML, EDI, etc) or Internet procurement networks to customer service linkage
All key participants in the supply chain, including strategic partners, have full visibility of the demand/supply plan	Supply Chain Event Management Systems
Vendor Managed Inventory (VMI)	See Glossary

Process Element: Identify, Prioritize, and Aggregate Product Requirements	Process Element Number: P2.1
Process Element Definition	
The process of identifying, prioritizing, and considering, as a whole with constituent parts, all sources of demand for a product or service in the supply chain .	
Performance Attributes	**Metric**
Reliability	Forecast Accuracy
Responsiveness	None Identified
Flexibility	None identified
Cost	None Identified
Assets	None Identified
Best Practices	**Features**
The demand plan is updated frequently to reflect actual consumption or customer forecast information	None Identified
Capacity and supply constraints are balanced against demand during the planning cycle Master production scheduling reflects management of capacity and/or supply constraints Sales and operations agree to limits of short term flexibility	None Identified

Inputs	Plan	Source	Make	Deliver	Return
Establish and Communicate Supply Chain Plans	P1.4				
Production Plans	P3.4				
Delivery Plans	P4.4				
Planning Data	EP.3				
Item Master, Bill of Materials, Product Routings	EP.7				
Order Signal				D2.3, D3.3	

Outputs	Plan	Source	Make	Deliver	Return

Process Element: Identify, Assess, and Aggregate Product Resources	Process Element Number: P2.2
Process Element Definition	
The process of identifying, evaluating, and considering, as a whole with constituent parts, all material and other resources used to add value in the supply chain for a product or services.	
Performance Attributes	**Metric**
Reliability	None Identified
Responsiveness	None Identified
Flexibility	None Identified
Cost	None identified
Assets	None Identified
Best Practices	**Features**
Capacity and supply constraints identified during MPS schedule process are balanced against demand during the planning cycle	None Identified
Inventory is planned at the part level, based on supply and demand variability. Inventory performance is measured at the dollar and unit levels Inventory targets are reviewed and adjusted frequently Obsolete inventory is reviewed at the part number level	None Identified

Inputs	Plan	Source	Make	Deliver	Return
(Supplier) Product Availability					
Inventory Availability		S1.4, S2.4, S3.6			
Sourced Product on Order		S1.1, S2.1, S3.3			
Product Inventory Targets		ES.4			
Planning Data	EP.3				

Outputs	Plan	Source	Make	Deliver	Return

Process Element: Balance Product Resources with Product Requirements	Process Element Number: P2.3
Process Element Definition	
The process of developing a time-phased course of action that commits resources to meet requirements.	
Performance Attributes	**Metric**
Reliability	Supplier on-time Delivery Performance
Responsiveness	None identified
Flexibility	None identified
Cost	Material planning costs % of purchased material
Assets	None Identified
Best Practices	**Features**
Suppliers share responsibility for balancing supply and demand through Joint Service Agreements	None Identified

Inputs	Plan	Source	Make	Deliver	Return
Planning Decision Policies	EP.1				

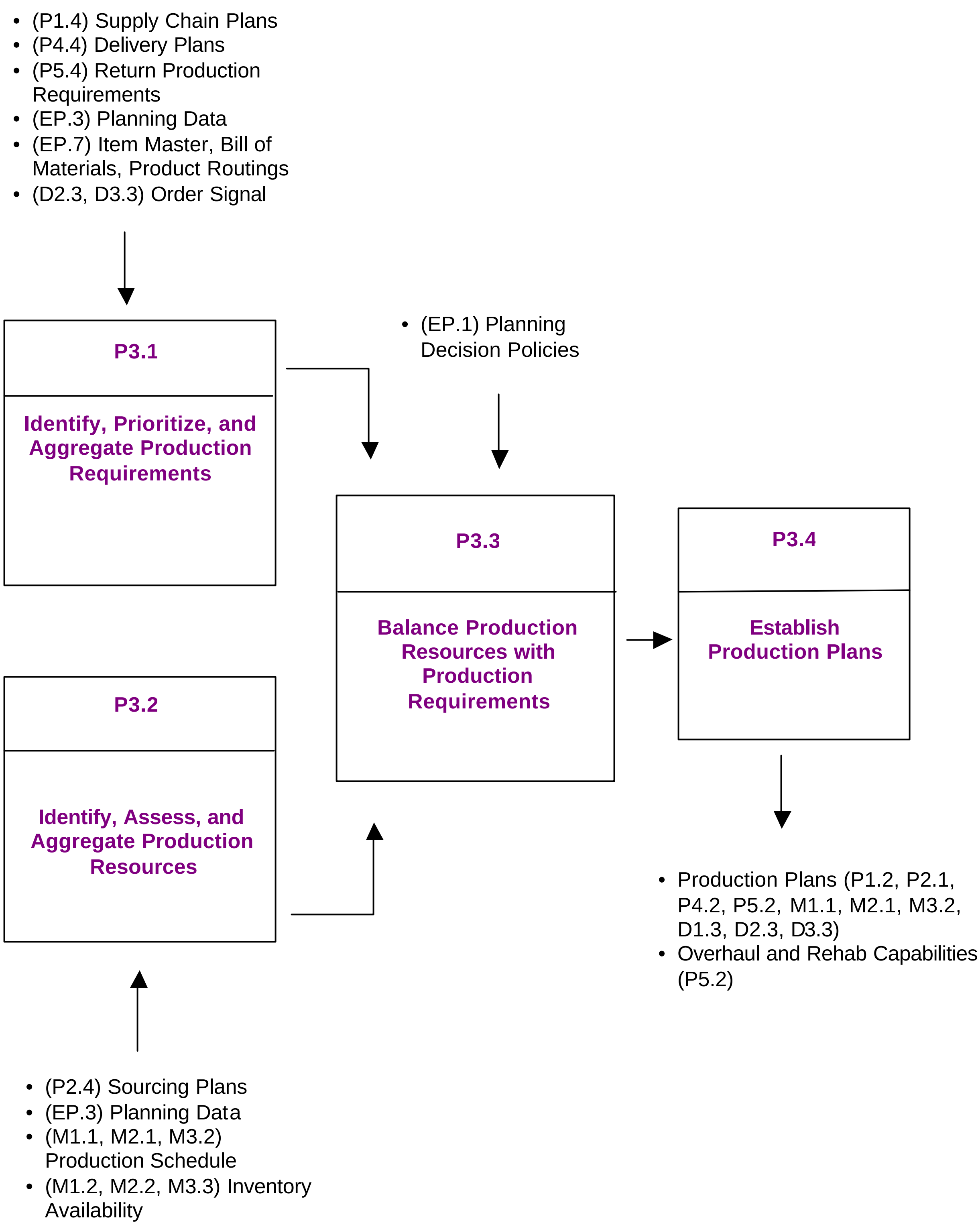
Outputs	Plan	Source	Make	Deliver	Return

Process Element: Establish Sourcing Plans	Process Element Number: P2.4
Process Element Definition	
The establishment of courses of action over specified time periods that represent a projected appropriation of supply resources to meet sourcing plan requirements.	
Performance Attributes	Metric
Flexibility and Responsiveness	**Supplier Cycle Time**
Reliability	Supplier on-time Delivery Performance Supplier Fill Rate
Responsiveness	None identified
Flexibility	None identified
Cost	None identified
Assets	None Identified
Best Practices	**Features**
Digital Linkage (EDI, XML, etc.) is used to provide real-time demand information and handle routine transactions	None Identified
Blanket purchase orders cover period requirements	None Identified

Inputs	Plan	Source	Make	Deliver	Return

Outputs	Plan	Source	Make	Deliver	Return
Sourcing Plans	P1.2, P3.2, P4.2, P5.1, P5.2	S1.1, S2.1, S3.1, S3.3, ES.3, ES.4		D1.3, D2.3, D3.3, DR1.4, DR2.4, DR3.4	

P3: Plan Make



• (P1.4) Supply Chain Plans
• (P4.4) Delivery Plans
• (P5.4) Return Production Requirements
• (EP.3) Planning Data
• (EP.7) Item Master, Bill of Materials, Product Routings
• (D2.3, D3.3) Order Signal
P3.1
Identify, Prioritize, and Aggregate Production Requirements
• (EP.1) Planning Decision Policies
P3.3
Balance Production Resources with Production Requirements
P3.4
Establish Production Plans
P3.2
Identify, Assess, and Aggregate Production Resources
• Production Plans (P1.2, P2.1, P4.2, P5.2, M1.1, M2.1, M3.2, D1.3, D2.3, D3.3)
• Overhaul and Rehab Capabilities (P5.2)
• (P2.4) Sourcing Plans
• (EP.3) Planning Data
• (M1.1, M2.1, M3.2) Production Schedule
• (M1.2, M2.2, M3.3) Inventory Availability

_Process Category: Plan Make __	Process Element Number: P3_
Process Category Definition	
The development and establishment of courses of action over specified time periods that represent a projected appropriation of production resources to meet production requirements.	
Performance Attributes	**Metric**
Reliability	Perfect Order Fulfillment
Responsiveness	None identified
Flexibility	Upside Make Flexibility Downside Make Adaptability Upside Make Adaptability
Cost	Total Make Costs % of (S+M+D) Costs
Assets	Cash to Cash Cycle Time Return on Supply Chain Fixed Assets
Best Practices	**Features**
Distinct and consistent linkages exist to ensure that disruptions and opportunities in production are quickly and accurately communicated and responses made	Multi-plant supply/demand planning and execution

Process Element: Identify, Prioritize, and Aggregate Production Requirements	Process Element Number: P3.1
Process Element Definition	
The process of identifying, prioritizing, and considering as a whole with constituent parts, all sources of demand in the creation of a product or service.	
Performance Attributes	**Metric**
Reliability	Forecast Accuracy
Responsiveness	None identified
Flexibility	None Identified
Cost	None Identified
Assets	None Identified
Best Practices	**Features**
Consideration of supplier's material availability in company's supply resources (including supplier's production plans & capability, inventory, and delivery plans)	Digital linkage to supplier quoting, planning, configuration and customer service applications

Inputs	Plan	Source	Make	Deliver	Return
Supply Chain Plans	P1.4				
Delivery Plans	P4.4				
Planning Data	EP.3				
Item Master, Bill of Materials, Product Routings	EP.7				
Order Signal				D2.3, D3.3	

Outputs	Plan	Source	Make	Deliver	Return

Process Element: Identify, Assess, and Aggregate Production Resources	Process Element Number: P3.2
Process Element Definition	
The process of identifying, evaluating, and considering, as a whole with constituent parts, all things that add value in the creation of a product or performance of a service.	
Performance Attributes	**Metric**
Reliability	None Identified
Responsiveness	None Identified
Flexibility	None Identified
Cost	None Identified
Assets	None Identified
Best Practices	**Features**
Inventory targets are reviewed and adjusted frequently	None Identified
Obsolete inventory is reviewed at the part number level	None Identified

Inputs	Plan	Source	Make	Deliver	Return
Sourcing Plans	P2.4				
Planning Data	EP.3				
Production Schedule			M1.1, M2.1, M3.2		
Inventory Availability			M1.2, M2.2, M3.3		

Outputs	Plan	Source	Make	Deliver	Return

Process Element: Balance Production Resources with Product Creation Requirements	Process Element Number: P3.3
Process Element Definition	
The process of developing a time-phased course of action that commits creation and operation resources to meet creation and operation requirements.	
Performance Attributes	**Metric**
Reliability	None Identified
Responsiveness	None Identified
Flexibility	None Identified
Cost	Plan Make Costs % of Make Costs
Assets	Total WIP Inventory DOS
Best Practices	**Features**
Inventory targets are reviewed and adjusted frequently	Digital Linkages using XML standards (RosettaNet, eBXML, OAGI) to automatically query inventory levels.
ERP-based Environmental Performance Indicator module (EPI module)	See Glossary

Inputs	Plan	Source	Make	Deliver	Return
Planning Decision Policies	EP.1				

Outputs	Plan	Source	Make	Deliver	Return

Process Element: Establish Production Plans	Process Element Number: P3.4
Process Element Definition	
The establishment of courses of action over specified time periods that represent a projected appropriation of supply resources to meet production and operating plan requirements.	
Performance Attributes	**Metric**
Reliability	Production Plan Adherence
Responsiveness	None identified
Flexibility	None Identified
Cost	None identified
Assets	Total WIP Inventory DOS
Best Practices	**Features**
Unplanned orders are accepted and scheduled only when there is no detrimental impact on overall product delivery plan	Digital Linkages using XML standards (RosettaNet, eBXML, OAGI) to automatically query production capacity and ATP and schedule unplanned orders.

Inputs	Plan	Source	Make	Deliver	Return

Outputs	Plan	Source	Make	Deliver	Return
Production Plans	P1.2, P2.1, P4.2		M1.1, M2.1, M3.2	D1.3, D2.3, D3.3	

P4: Plan Deliver

- (P1.4) Supply Chain Plans
- (P5.4) Deliver Return Requirements
- (EP.1) Service Levels
- (EP.3) Planning Data
- (EP.7) Item Master
- (EP.7) Routings
- (D1.3, D2.3, D3.3) Order Backlog
- (Customer) Customer Requirements
- Merchandise category/classification
- Product/category lifecycle
- (D4.6) Point of Sale Data (daily)
- Store Shelf Inventory Counts
- DC/Vendor Lead Time
- DC/Vendor Transit Time
- Year-to-Year for Like SKU/Subclass
- Stock-out History
- Promotion/Event Plans
- Markdown Plans
- Actual Shrink
- EOQ/ESQ's

P4.1

Identify, Prioritize, and Aggregate Delivery Requirements

- Item Stocking Requirements (D4.2)
- Store Allocation Instructions

- (EP.1) Planning Decision Policies

P4.3

Balance Delivery Resources with Delivery Requirements

P4.4

Establish Delivery Plans

- Delivery Plans (P1.2, P2.1, P3.1, P5.1, D1.3, D2.3, D3.3)
- Stocking Requirements (D4.1)

P4.2

Identify, Assess, and Aggregate Delivery Resources

- (P2.4) Sourcing Plans
- (P3.4) Production Plans
- (P5.4) Deliver Return Requirements
- (EP.3) Planning Data
- (D1.3, D2.3) Inventory Availability/Delivery Date
- (D1.5, D2.5, D3.5) Load Information
- (D3.3) Resource Availability

Process Element: Plan Deliver	Process Element Number: P4
Process Element Definition	
The development and establishment of courses of action over specified time periods that represent a projected appropriation of delivery resources to meet delivery requirements.	
Performance Attributes	**Metric**
Reliability	Perfect Order Fulfillment
Responsiveness	Order Management Cycle Time
Flexibility	Upside Deliver Flexibility Downside Deliver Adaptability Upside Deliver Adaptability
Cost	Total Deliver Costs as % of (S+M+D) Costs
Assets	Cash to Cash Cycle Time Return on Supply Chain Fixed Assets
Best Practices	**Features**
Distinct and consistent linkages exist to ensure disruptions and opportunities in delivery resources are quickly and accurately communicated and responded to	Tightly integrated DRP/ERP Systems Supply Chain Event Management Systems Trading Partner Networks including Third Party Logistics Providers
Proactive education of customers to set expectations and encourage close working relationships (knowledge of long-lead items, visibility to supply resources, agreement on levels of flexibility)	None Identified
Vendor Managed Inventory (VMI)	See Glossary

Process Element: Identify, Prioritize, and Aggregate Delivery Requirements	Process Element Number: P4.1
Process Element Definition	
The process of identifying, prioritizing, and considering, as a whole with constituent parts, all sources of demand in the delivery of a product or service.	
Performance Attributes	**Metric**
Reliability	Forecast Accuracy Sales Floor Error Rates On Shelf Locations Shelf SKU Accuracy
Responsiveness	None Identified
Flexibility	None Identified
Cost	None Identified
Assets	None Identified
Best Practices	**Features**
Eliminate “special deals” sales to reduce returns and improve forecast accuracy (reduces uncertainty, lowers safety stock requirements, cheaper to administer)	None Identified
Customer relationship and Digital linkages (XML, EDI, etc.) provide accurate visibility into actual demand via customer forecasts, product plans, production plans, and inventory positions	Tightly integrated supply chain or demand planning with point of sale and customer inventory systems
Vendor managed inventory program in which sourcing entity manages customer inventory and plans replenishment	VMI support in demand planning or supply chain planning
Forecasts are replaced with actual customer replenishment signals and orders where possible	B2B Integration and Application Server Systems
Unplanned orders are accepted only when there is no impact on overall product delivery plan	None Identified
Electronic matching between POS data and store inventory (shelves and back room)	Integrated software systems
Matching shelf stock to expectations	A software based system that corrects shelf inventory levels based on actual product present (possible RFID solution). Identifies stock-outs from shrinkage or item misplacement
Ideal Stock position Based on Days/Weeks of Supply	Pilot by Wal-Mart/MIT
RFID and other tagging	POG software/field force
Planogram Flexibility for Seasonal/Promotional Changes	None Identified

Inputs	Plan	Source	Make	Deliver	Return
(Customer) Customer Requirements					
Supply Chain Plans	P1.4				
Deliver Return Requirements	P5.4				
Planning Data	EP.3				
Service Levels	EP.9				
Item Master	EP.7				
Routings	EP.7				
Order Backlog				D1.3, D2.3, D3.3	
Merchandise category/classification					
Product/category lifecycle					
Point of Sale Data (daily)				D4.6	
Store Shelf Inventory Counts					
DC/Vendor Lead Time					
DC/Vendor Transit Time					
Year-to-Year for Like SKU/Subclass					
Stock-out History					
Promotion/Event/ Markdown Plans					
Actual Shrink					
EOQ/ESQ's					

Outputs	Plan	Source	Make	Deliver	Return
Item Stocking Requirements				D4.2	
Store Allocation Instructions					

Process Element: Identify, Assess, and Aggregate Delivery Resources	Process Element Number: P4.2
Process Element Definition	
The process of identifying, evaluating, and considering, as a whole with constituent parts, all things that add value in the delivery of a product.	
Performance Attributes	**Metric**
Reliability	Forecast Accuracy
Responsiveness	None Identified
Flexibility	None Identified
Cost	None identified
Assets	None Identified
Best Practices	**Features**
None Identified	None Identified

Inputs	Plan	Source	Make	Deliver	Return
Sourcing Plans	P2.4				
Production Plans	P3.4				
Planning Data	EP.3				
Inventory Availability/Delivery Date				D1.3, D2.3	
Load Information				D1.5, D2.5, D3.5	
Resource Availability				D3.3	

Outputs	Plan	Source	Make	Deliver	Return

Process Element: Balance Delivery Resources with Delivery Requirements	Process Element Number: P4.3
Process Element Definition	
The process of developing a time-phased course of action that commits delivery resources to meet delivery requirements	
Performance Attributes	**Metric**
Reliability	Delivery Performance to Customer Commit Date
Responsiveness	None Identified
Flexibility	None Identified
Cost	Plan Deliver Costs as % of Deliver Costs
Assets	None Identified
Best Practices	**Features**
Demand priorities reflecting strategic customer relationships as business policies are automatically followed in allocating resources; First-In-First-Out (FIFO) is utilized as the default scheduling priority	Rules-based distribution planning system Trading partner agreements

Inputs	Plan	Source	Make	Deliver	Return
Planning Decision Policies	EP.1				

Outputs	Plan	Source	Make	Deliver	Return

Process Element: Establish Delivery Plans	Process Element Number: P4.4
Process Element Definition	
The establishment of courses of action over specified time periods that represent a projected appropriation of delivery resources to meet delivery requirements.	
Performance Attributes	**Metric**
Reliability	Delivery Performance to Customer Commit Date Fill Rate
Responsiveness	None Identified
Flexibility	None Identified
Cost	None Identified
Assets	Finished Goods Inventory
Best Practices	**Features**
Plans which do not violate business rules are communicated openly and cross-functionally for execution	None Identified
Plans that violate business rules (e.g. Joint Service Agreements) are addressed cross-functionally, considering total business impacts (revenue, cost, quality, customer service, etc.)	None Identified
To address conditions which cannot be adequately satisfied during the current planning period, each functional area develops prioritized recommendations for the subsequent planning period	None Identified
Specific changes to the plan are agreed to cross-functionally, according to defined business rules	None Identified

Inputs	Plan	Source	Make	Deliver	Return

Outputs	Plan	Source	Make	Deliver	Return
Delivery Plans	P1.2, P2.1, P3.1			D1.3, D2.3, D3.3	
Stocking Requirements				D4.1	

P5: Plan Return

- (P1.4, P2.4, P3.4, P4.4) Supply Chain Plans
- (EP.3) Planning Data
- (EP.5, EP.9) Revised Business Assumptions
- (EP.7) Item Master, Product Routings
- (EP.9) (Marketing, Sales, Product Management/Engineering) Revised Aggregate Forecast and Projections
- (D1, D2, D3) Actual Sales History
- (DR1.1, DR2.1, DR3.1, SR1.3, SR2.3, SR3.3) Historical Return Rates
- (ER.1) Business Rules for Return Processes
- (ER.8) Regulatory Requirements
- (Marketing, Sales, Legal) Contractual Obligations

- (EP.1) Planning Decision Policies
- (EP.2) Supply Chain Performance Improvement Plan

P5.1

Identify, Prioritize, and Aggregate Return Requirements

P5.3

Balance Return Resources with Return Requirements

P5.4

Establish and Communicate Return Plans

P5.2

Identify, Assess, and Aggregate Return Resources

- Source Return Requirements (P2.1)
- Return Production Requirements (P3.1)
- Deliver Return Requirements (P4.2)
- Return Plans (SR1.2, SR2.2, SR3.2, DR1.1, DR2.1, DR3.1, ER.4, ER.5, ER.6, ER.7)
- Return Rules and Policies (ER.1)
- Product Return Capabilities (DR1.1, DR3.1)
- Process Procedures (ER.1, ER.2, ER.8)

- (P2.4) Sourcing Plans
- (P3.4) Production Plans/
- (P4.4) Delivery Plans
- (EP.1) Planning Decision Policies
- (EP.2) Return Process Capabilities
- (EP.3) Planning Data
- (EP.4) Inventory Strategy
- (EP.5) Revised Capital Plan, Make/Buy Decision
- (EP.6) Projected Internal & External Capacity, Outsource Plan
- (EP.8) Regulatory Requirements
- (EP.9) Budget Constraints
- (DR1.3, DR1.4, DR2.3, DR2.4, DR3.3, DR3.4) Return Inventory Transfer Data
- (ER.1) Business Rules for Return Processes
- (ER.2, ER.5) MRO Product Return Capabilities
- (ER.3) Data & Return Capabilities
- (ER.4) Return Inventory Targets
- (ER.6) Return Transportation Guidelines, Policies, & Agreements
- (ER.7) Return Process Workflow Definitions & Policies
- (ER.8) Regulatory Requirements

Process Element: Plan RETURN	Process Element Number: P5
Process Element Definition	
A strategic or tactical process to establish and adjust courses of action or tasks over specified time periods that represent a projected appropriation of return resources and assets to meet anticipated as well as unanticipated return requirements. The scope includes unplanned returns of sold merchandise as well as planned returns of “rotable” products that are refurbished for reissue to customers.	
Performance Attributes	**Metric**
Reliability	Perfect Order Fulfillment
Responsiveness	None Identified
Flexibility	Upside Source Return Flexibility Upside Source Return Adaptability
Costs	Return Costs as % of (S+M+D) Costs
Assets	Return Assets Utilization Return Inventory Value Return Inventory Turns Return on Supply Chain Fixed Assets
Best Practices	**Features**
Use Demand Planning	Demand Planning Systems to forecast returns, predict yield rates for reusable products or components, determine demand in a resale market, and project a revenue stream.
Planning and Forecasting Outsourced RETURN process	Collaborative planning and forecasting with RETURN outsourcing partners (3PL, reverse drop shippers, etc.)

Process Element :Identify, Assess, and Aggregate Return Requirements	Process Element Number: P5.1
Process Element Definition	
The process of identifying, evaluating, and considering, as a whole with constituent parts, all sources of demand for the return of a product.	
Performance Attributes	**Metric**
Reliability	Return Forecast Accuracy
Responsiveness	None Identified
Flexibility	None Identified
Cost	None Identified
Assets	None Identified
Best Practices	**Features**
Real time RETURN anticipation	Having real time data on return demand and including it in the plan and forecast. Requires a connection with customers, call centers or CRM system, possibly to the store level with retail returns. The return demand needs to be included in the production plan as soon as possible because upon repair it may be the next piece of serviceable inventory to satisfy demand.
Use Historical Based Return Rate Forecasts	Use historical return data to determine an historical return rate for individual products and/or for product groups and then apply these return rates against both forecasted sales and actual sales. The historical return data can also include statistics regarding the latency time between the sale (delivery date) and the return authorization request.

Inputs	Plan	Source	Make	Deliver	Return
Supply Chain Plans	P1.4, P2.4, P3.4, P4.4				
Planning Data (including data from CRM or sales return system)	EP.3				
Revised Business Assumptions	EP.5, EP.9, Marketing, Sales, Product Mgmt/ Engineer-ing				
Item Master	EP.7				
Product Routings	EP.7				
Revised Aggregate Forecast and Projections	EP.9, Marketing, Sales, Product Mgmt./ Engineer-ing				

Actual Sales History				D1, D2, D3	
Historical Return Rates					DR1.1, DR2.1, DR3.1, SR1.3, SR2.3, SR3.3
Business Rules for Return Processes					ER.1
Regulatory Requirements					ER.8
Contractual Obligations	Marketing, Sales, Legal				

Outputs	**Plan**	**Source**	**Make**	**Deliver**	**Return**

Process Element: Identify, Assess, and Aggregate Return Resources	Process Element Number: P5.2
Process Element Definition	
The process of identifying, evaluating, and consideration for all resources that add value to, execute, or constrain the processes for the return of a product.	
Performance Attributes	**Metric**
Reliability	None Identified
Responsiveness	None Identified
Flexibility	None Identified
Cost	None Identified
Assets	None Identified
Best Practices	**Features**
Rapid reconfiguration of RETURN capacity	Use of RETURN tracking and projection systems and flexible partner agreements that allow the rapid addition of RETURN capacity to match unexpected demand.
Joint Service Agreements with Source suppliers to share responsibilities and costs of returns	Collaborative planning tools with the Source suppliers
Allow Source suppliers full visibility into the current return situations and the forecasted return activity	Shared supply chain forecasting and event management functionality with Source suppliers

Inputs	Plan	Source	Make	Deliver	Return
Sourcing Plans	P2.4				
Production Plans	P3.4				
Delivery Plans	P4.4				
Planning Decision Policies	EP.1				
Return Process Capabilities	EP.2				
Planning Data	EP.3				
Inventory Strategy	EP.4				
Revised Capital Plan, Make/Buy Decision	EP.5				
Projected Internal & External Production Capacity; Outsource Plan	EP.6				
Regulatory Requirements	EP.8				
Budget Constraints	EP.9				
Return Inventory Transfer Data					DR1.3, DR1.4, DR2.3, DR2.4, DR3.3, DR3.4
Business Rules for Return Processes					ER.1
MRO Product Return Capabilities					ER.2, ER.5
Data & Return Capabilities					ER.3
Return Inventory Targets					ER.4
Return Transportation Guidelines, Policies, & Agreements					ER.6
Return Process Workflow Definition & Policies					ER.7
Regulatory Requirements					ER.8

Outputs	Plan	Source	Make	Deliver	Return

Process Element: Balance Return Resources with Return Requirements	Process Element Number: P5.3
Process Element Definition	
The process of developing courses of action that make feasible the commitment the appropriate return resources and or assets to satisfy return requirements.	
Performance Attributes	**Metric**
Reliability	None Identified
Responsiveness	None Identified
Flexibility	None Identified
Cost	Plan Return Costs as % of Return Costs
Assets	None Identified
Best Practices	**Features**
Dynamic return restocking management	Dynamic prioritization of restocking plans in order to rapidly re-sell products that are in demand thus reducing new inventory demand.
Advance Planning Engines applied to returns.	Advanced math model "solvers" that optimize / minimize constraints, routing, restocking priorities and costs.

Inputs	Plan	Source	Make	Deliver	Return
Planning Decision Policies	EP.1				
Supply Chain Performance Improvement Plan	EP.2				

Outputs	Plan	Source	Make	Deliver	Return

Process Element: Establish and Communicate Return Plans	Process Element Number: P5.4
Process Element Definition	
The establishment and communication of courses of action over specified time periods that represent a projected appropriation of required return resources and or assets to meet return process requirements.	
Performance Attributes	**Metric**
Reliability	None Identified
Responsiveness	None Identified
Flexibility	None Identified
Cost	None Identified
Assets	None Identified
Best Practices	**Features**
Rapid, dynamic reconfiguration of RETURN process to meet demand	The ability to reset and reconfigure the RETURN process capacity, routings, etc. by transmitting new requirements and directives using mathematical models, the Internet, outsourcing and flexible partnership agreements. Also requires integration with the CRM system for real time redirection of customer returns based upon cost and capacity.
Full internal (and external if Source suppliers share in the Return process responsibilities) visibility to RETURN plans	Intranet and Extranet communications tools

Inputs	Plan	Source	Make	Deliver	Return

Outputs	Plan	Source	Make	Deliver	Return
Source Return Requirements	P2.1				
Return Production Requirements	P3.1				
Deliver Return Requirements	P4.2				
Return Plans					SR1.2, SR2.2, SR3.2, DR1.1, DR2.1, DR3.1, ER.4, ER.5, ER.6, ER.7,
Return Rules and Policies					DR1.1, DR3.1, ER.1
Product Return Capabilities					DR1.1, DR3.1
Process Procedures					ER.1, ER.2, ER.8

EP: Enable Plan

- Business Plan
- Strategic Plan
- Service Requirements

EP.1

Manage Business Rules for Plan Processes

- Planning Decision Policies (P1.3, P2.3, P3.3, P4.3, P5.3)
- Service Levels (P4.1)

- Supply-Chain Performance Metrics
- Continuous Improvement Process

EP.2

Manage Performance of Supply Chain

- Supply Chain Performance Improvement Plan (P1.3, P5.3)
- Return Process Capabilities (P5.2)

- Supply Chain Execution Data

EP.3

Manage Plan Data Collection

- Planning Data (P1.1, P1.2, P2.1, P2.2, P3.1, P3.2, P4.1, P4.2, P5.1, P5.2)

- Product Routings
- Capacity Constraints
- Planning Decision Policies

EP.4

Manage Integrated Supply Chain Inventory

- Inventory Strategy (P1.3, P5.2)
- Manage Integrated Supply Chain Inventory Information (DR2.1)

- Product Routings
- Capacity Constraints
- Planning Decision Policies

EP.5

Manage Integrated Supply Chain Capital Assets

- Revised Capital Plan (P1.2, P5.2)
- Projected Internal and External Capacity (P1.2)
- Make/Buy Decision ((P1.1, P5.1)
- Revised Business Assumptions (P1.1, P5.2)

EP: Enable Plan

- Product Routings
- Capacity Constraints
- Planning Decision Policies

EP.6

Manage Integrated Supply Chain Transportation

- Projected Internal and External Capacity (P1.2, P5.2)
- Outsource Plan (P1.2, P5.2)

EP.7

Manage Planning Configuration

- Item Master (P2.1, P3.1, P4.1, P5.1)
- Bill of Materials (P2.1, P3.1)
- Product Routings (P2.1, P3.1, P4.1, P5.1)

EP.8

Manage Plan Regulatory Requirements and Compliance

- Regulatory Requirements (P1.2)

- Business Plan
- Strategic Plan

EP.9

Align Supply Chain Unit Plan with Financial Plan

- Revised Aggregate Forecast and Projections (P1.1, P5.1)
- Revised Business Assumptions (P1.1, P5.1)

Enable Process: Manage Business Rules for PLAN Processes	Process Number: EP.1
Enable Process Definition	
The process of establishing, maintaining, and enforcing decision support criteria for Supply Chain Planning which translate to rules for conducting business, i.e. developing and maintaining customer and channel performance standards of an entire supply chain such as service levels, given service requirements by supply chain stakeholders/trading partners. Business rules align PLAN process policies with business strategy, goals, and objectives.	
Performance Attributes	**Metric**
Reliability	None Identified
Responsiveness	None Identified
Flexibility	None Identified
Cost	None Identified
Assets	None Identified
Best Practices	**Features**
Integrated business and supply chain planning processes where cross-functional input is leveraged to set business rules.	Supply Chain performance dashboard capability.

Inputs	Plan	Source	Make	Deliver	Return
Business Plan					
Strategic Plan					
Service Requirements					

Outputs	Plan	Source	Make	Deliver	Return
Planning Decision Policies	P1.3, P2.3, P3.3, P4.3, P5.3)				
Service Levels	P4.1				

Enable Process: Manage Performance of Supply Chain	Process Number: EP.2
Enable Process Definition	
The process of measuring actual integrated Supply Chain performance against internal and/or external standards to develop and implement a course of action to achieve targeted performance levels. Performance targets established for the execution of supply chain processes are reflected in the process elements for PLAN, i.e. cost, delivery reliability, cycle time, responsiveness, and assets.	
Performance Attributes	**Metric**
Reliability	None Identified
Responsiveness	None Identified
Flexibility	None Identified
Cost	None Identified
Assets	None identified
Best Practices	**Features**
Reliable Continuous Improvement Process and Methodology.	None Identified
Efficient and effective benchmarking process leveraging cross industry metrics and definitions.	None Identified
Sound Project Management Process and Methodology.	None Identified

Inputs	Plan	Source	Make	Deliver	Return
Supply-Chain Performance Metrics					
Continuous Improvement Process					

Outputs	Plan	Source	Make	Deliver	Return
Supply Chain Performance Improvement Plan	P1.3, P5.3				
Return Process Capabilities	P5.2				

Enable Process: Manage PLAN Data Collection	Process Number: EP.3
Enable Process Definition	
The process of collecting, integrating and maintaining the accuracy of supply chain execution information necessary to plan the balance of supply chain resources to demand requirements at both the highest aggregate and lowest SKU planning levels.	
Performance Attributes	**Metric**
Reliability	None Identified
Responsiveness	None identified
Flexibility	None Identified
Cost	None Identified
Assets	None Identified
Best Practices	**Features**
Integrated Demand and Supply Planning - Demand Planning, Supply Planning and especially the Supply Plan Execution are no longer disconnected. All required planning and execution data is integrated and shared in between all functional areas within an organization.	Memory based planning systems provide one single data model and data mart (including the business rules) for the entire supply chain planning and execution process. Algorithms use the business rules as the driver for the planning engine.
Collaborative Planning – Planning information (POS information, Demand History, Forecast, Production Schedule etc.) is shared in between suppliers, manufacturers, service providers and customers.	Modern supply chain planning systems and communication technologies (XML, web enabled EDI) as well as newly defined standards (e.g. CPFR, eBXML, RosettaNet) supports the real-time information exchange in between the business community.
Single data source for decision support and business rules.	A data warehouse/data mart is the source of all planning (master) data, business rules and transaction data. Analyzing tools enable the ongoing maintenance and improvement of the business rules based on actual data.

Inputs	Plan	Source	Make	Deliver	Return
Supply Chain Execution Data					

Outputs	Plan	Source	Make	Deliver	Return
Planning Data	P1.1, P1.2, P2.1, P2.2, P3.1, P3.2, P4.1, P4.2, P5.1, P5.2)				

Enable Process: Manage Integrated Supply Chain Inventory	Process Number: EP.4
Enable Process Definition	
The process of establishing total supply chain inventory strategy and planning the total inventory limits or levels (including Raw Material, Work In Process, Finished and Purchased Finished Goods) including replenishment models, ownership, product mix, and stocking locations, both inter and intra company.	
Performance Attributes	**Metric**
Reliability	None Identified
Responsiveness	None Identified
Flexibility	None Identified
Cost	None Identified
Assets	None Identified
Best Practices	**Features**
Capability to run multiple “simulated” full-stream supply/demand balancing against long-term capacity plans and scenarios.	Supply Chain modeling capabilities, i.e. Advanced Planning Systems.

Inputs	Plan	Source	Make	Deliver	Return
Product Routings					
Capacity Constraints					
Planning Decision Policies					

Outputs	Plan	Source	Make	Deliver	Return
Inventory Strategy	P1.3, P5.2				
Manage Integrated Supply Chain Inventory Information					DR2.1

Enable Process: Manage Integrated Supply Chain Capital Assets	Process Number: EP.5
Enable Process Definition	
The process of defining capacity strategy (i.e. internal versus contract manufacturing or internal versus 3rd Party Logistics) and then acquiring, maintaining and dispositioning an organization's capital assets to operate the integrated supply chain.	
Performance Attributes	**Metric**
Reliability	None Identified
Responsiveness	None Identified
Flexibility	None Identified
Cost	None Identified
Assets	Plan Fixed Asset Costs
Best Practices	**Features**
Use of Cross Functional Teams to execute the process of developing Long-Term Capacity and Resource Plans.	None Identified
Alignment of strategic and business plans with long-term capacity and resource planning.	None Identified
Capability to run multiple "simulated" full-stream supply/demand balancing against long-term capacity plans and scenarios.	Supply Chain modeling capabilities, i.e. Advanced Planning Systems.

Inputs	Plan	Source	Make	Deliver	Return
Product Routings					
Capacity Constraints					
Planning Decision Policies					

Outputs	Plan	Source	Make	Deliver	Return
Revised Capital Plan	P1.2, P5.2				
Projected Internal and External Capacity	P1.2				
Make/Buy Decision	P1.1, P5.2				
Revised Business Assumptions	P1.1, P5.1				

Enable Process: Manage Integrated Supply Chain Transportation	Process Number: EP.6
Enable Process Definition	
The process of defining an integrated supply chain transportation strategy and maintaining the information which characterizes total supply chain transportation requirements, and the management of transporters both inter and intra company.	
Performance Attributes	**Metric**
Reliability	None Identified
Responsiveness	None Identified
Flexibility	None Identified
Cost	None Identified
Assets	None Identified
Best Practices	**Features**
Use of Cross Functional Teams to execute the process of developing Long-Term Capacity and Resource Plans.	None Identified
Alignment of strategic and business plans with long-term capacity and resource planning	None Identified
Capability to run multiple "simulated" full-stream supply/demand balancing against long-term capacity plans and scenarios.	Supply Chain modeling capabilities, i.e. Advanced Planning Systems.

Inputs	Plan	Source	Make	Deliver	Return
Product Routings					
Capacity Constraints					
Planning Decision Policies					

Outputs	Plan	Source	Make	Deliver	Return
Projected Internal and External Capacity	P1.2, P5.2				
Outsource Plan	P1.2, P5.2				

Enable Process: Manage Planning Configuration	Process Number: EP.7
Enable Process Definition	
The process of defining and maintaining the information about a unique supply chain network for a group of similar or complimentary products through their full life cycle, including the evaluation of market need, product realization (development, introduction and production), product discontinuation, and after-market support. This element also includes the management of critical sub processes needed to manage the life cycle of individual item numbers including item masters, routings, event planning (promotions, etc.), ABC classification, rationalization, and bill of materials.	
Performance Attributes	**Metric**
Reliability	Forecast Accuracy
Responsiveness	None Identified
Flexibility	None Identified
Cost	None Identified
Assets	None Identified
Best Practices	**Features**
ABC Classification	None Identified
SKU Rationalization	None Identified
Use of Platform Teams in the New Product Development Process	None Identified
Incorporates leading practices such as Efficient Consumer Response, Collaborative Planning, Forecasting, and Replenishment, Vendor Managed Inventory, and real time point of consumption reporting.	None Identified
New Items Introductions are part of the Sales and Operations Planning Process at the General Management Business Team Level	None Identified

Inputs	Plan	Source	Make	Deliver	Return

Outputs	Plan	Source	Make	Deliver	Return
Item Master	P2.1, P3.1, P4.1, P5.1				
Bill of Materials	P2.1, P3.1				
Product Routings	P2.1, P3.1, P4.1, P5.1				

Enable Process: Manage PLAN Regulatory Requirements and Compliance	Process Number: EP.8
Enable Process Definition	
The process of identifying and complying with regulatory documentation and process standards set by external entities (i.e. government, trade officials, etc.) when planning for the integrated supply chain network.	
Performance Attributes	**Metric**
Reliability	None Identified
Responsiveness	None Identified
Flexibility	None Identified
Cost	None Identified
Assets	None Identified
Best Practices	**Features**
None Identified	None Identified

Inputs	Plan	Source	Make	Deliver	Return

Outputs	Plan	Source	Make	Deliver	Return
Regulatory Requirements	P1.2				

Enable Process: Align Supply Chain Unit Plan with Financial Plan	Process Number: EP.9
Enable Process Definition	
The process of revising the long-term supply chain capacity and resource plans, given the inputs from the strategic and business plans. This includes revision of not only aggregate forecast and projections related to supply chain, source, make, and delivery plans, but also business assumptions.	
Performance Attributes	**Metric**
Reliability	None Identified
Responsiveness	None Identified
Flexibility	None Identified
Cost	None Identified
Assets	None Identified
Best Practices	**Features**
Strategic Sales and Operations Planning process in place and managed at the executive level.	None Identified
A Re-planning process links the supply chain operation with the Business Strategy and the Marketing Strategy.	None Identified
A Re-planning process exists in multi-levels of the Supply Chain between business enterprises.	Business to business internet capability to share common data.

Inputs	Plan	Source	Make	Deliver	Return
Business Plan					
Strategic Plan					

Outputs	Plan	Source	Make	Deliver	Return
Revised Aggregate Forecast and Projections	P1.1, P5.1				
Revised Business Assumptions	P1.1, P5.1				

SOURCE

S1: Source Stocked Product

- (P2.4) Sourcing Plans
- (ES.2) Source Execution Data
- (ES.6) Logistics Selection
- (M1.1, M2.1, M3.2) Production Schedule
- (M1.2, M2.2, M3.3, D1.3) Replenishment Signals
- (DR1.4, DR2.4, DR3.4) Return Inventory Transfer Data
- (DR1.4) Defective Products
- (DR2.4) MRO Products
- (DR3.4) Excess Products

S1.1

Schedule Product Deliveries

- Procurement Signal (Supplier)
- Sourced Product on Order (P2.2), (ES.9)
- Scheduled Receipts (M1.1, M2.1, M3.2, D1.8, D4.2)

- (Supplier) Sourced Products
- (DR2.4) MRO Products

S1.2

Receive Product

- Receipt Verification (ES.1, ES.2, ES.6 ES.8)

S1.3

Verify Product

- Receipt Verification (ES.1, ES.2)

- (M) (D) Product Pull Signals
- (ES.4) Product Inventory Location
- (EM) WIP Inventory Location
- (ED) Finished Goods Inventory Location

S1.4

Transfer Product

- Inventory Availability (P2.2, ES.4, M1.2, M2.2, M3.3, D1.8, D4.2)
- Daily Replenishment Requirements (D4.1)
- Loaded Cart (D4.4)

- (ES.9) Payment Terms

S1.5

Authorize Supplier Payment

Process Category: Source Stocked Product	Process Number: S1
Process Category Definition	
The procurement, delivery, receipt and transfer of raw material items, subassemblies, product and or services.	
Performance Attributes	**Metric**
Reliability	Perfect Order Fulfillment
Responsiveness	Source Cycle Time
Flexibility	Upside Source Flexibility Downside Source Adaptability Upside Source Adaptability
Cost	Product Acquisition Costs as % of Source (S1) Costs
Assets	Cash to Cash Cycle Time Return on Supply Chain Fixed Assets
Best Practices	**Features**
Joint Service Agreements Alliance and Leverage agreements	None Identified

Process Element: Schedule Product Deliveries	Process Element Number: S1.1
Process Element Definition	
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**
Reliability	% Schedules Generated within Supplier's Lead Time % Schedules Changed within Supplier's Lead Time
Responsiveness	Schedule Product Deliveries Cycle Time
Flexibility	None Identified
Cost	Schedule Deliveries Costs as a % of Product Acquisitions Costs
Assets	None Identified
Best Practices	**Features**
Utilize EDI transactions to reduce cycle time and costs	EDI interface for 830, 850, 856 & 862 transactions
Mechanical (Kanban) pull signals are used to notify suppliers of the need to deliver product	Electronic Kanban support
Consignment agreements are used to reduce assets and cycle time while increasing the availability of critical items	Consignment inventory management
Advanced ship notices allow for tight synchronization between SOURCE and MAKE processes	Blanket order support with scheduling interfaces to external supplier systems
Vendor Managed Inventory (VMI)	See Glossary

Inputs	Plan	Source	Make	Deliver	Return
Sourcing Plans	P2.4				
Source Execution Data		ES.2			
Logistics Selection		ES.6			
Production Schedule			M1.1, M2.1, M3.2		
Replenishment Signals			M1.2, M2.2, M3.3	D1.3	
Return Inventory Transfer Data					DR1.4, DR2.4, DR3.4
Defective Products					DR1.4
MRO Products					DR2.4
Excess Products					DR3.4

Outputs	Plan	Source	Make	Deliver	Return
Procurement Signal (Supplier)					
Sourced Product on Order	P2.2	ES.9			
Scheduled Receipts			M1.1, M2.1, M3.2	D1.8, D4.2	

Process Element: Receive Product	Process Element Number: S1.2
Process Element Definition	
The process and associated activities of receiving product to contract requirements.	
Performance Attributes	**Metric**
Reliability	% Orders/ lines received damage free % Orders/ lines received complete % Orders/ lines received on-time to demand requirement % Orders/ lines received with correct shipping documents
Responsiveness	Receive Product Cycle Time
Flexibility	None Identified
Cost	Receiving costs as a % of Product Acquisition Costs
Assets	None Identified
Best Practices	**Features**
Supplier certification programs are used to reduce (skip lot) or eliminate receiving inspection	Skip lot / sampling inspection logic
Bar coding is used to minimize handling time and maximize data accuracy	Bar code interface for data collection devices Generate bar coded receiving documents
Deliveries are balanced throughout each working day and throughout the week	None Identified
Supplier delivers directly to point of use – (dock to line or end destination)	Electronic Tag tracking to Point of Use (POU) destination
Supplier (Carrier) Agreements	See Glossary

Inputs	Plan	Source	Make	Deliver	Return
(Supplier) Sourced Products					
MRO Products					DR2.4

Outputs	Plan	Source	Make	Deliver	Return
Receipt Verification		ES.1, ES.2, ES.6, ES.8			

Process Element: Verify Product	Process Element Number: S1.3
Process Element Definition	
The process and actions required determining product conformance to requirements and criteria.	
Performance Attributes	**Metric**
Reliability	% Orders / line received defect free
Responsiveness	Verify Product Cycle Time
Flexibility	None Identified
Cost	Verification costs as a % of Product Acquisition Costs
Assets	None Identified
Best Practices	**Features**
Supplier certification programs are used to reduce (skip lot) or eliminate receiving inspection	Skip lot/sampling inspection logic
Bar coding is used to minimize handling time and maximize data accuracy	Bar code interface for data collection devices Generate bar coded receiving documents
Deliveries are balanced throughout each working day and throughout the week	None Identified
Supplier delivers directly to point of use	Electronic Tag tracking to Point of Use (POU) destination
Supplier replaces defective material at customer's facility with good product as required.	Electronic Tag tracking to Point of Use (POU) destination

Inputs	Plan	Source	Make	Deliver	Return

Outputs	Plan	Source	Make	Deliver	Return
Receipt Verification		ES.1, ES.2			

Process Element: Transfer Product	Process Element Number: S1.4
Process Element Definition	
The transfer of accepted product to the appropriate stocking location within the supply chain. This includes all of the activities associated with repackaging, staging, transferring and stocking product. For service this is the transfer or application of service to the final customer or end user.	
Performance Attributes	**Metric**
Reliability	% Product transferred damage free % Product transferred complete % Product transferred on-time to demand requirement % Product transferred without transaction errors
Responsiveness	Transfer Product Cycle Time
Flexibility	None Identified
Cost	Transfer & Product storage costs as a % of Product Acquisition Costs
Assets	Inventory DOS
Best Practices	**Features**
Drive deliveries directly to stock or point-of-use in manufacturing to reduce costs and cycle time	Pay on receipt Specify delivery location and time (to the minute) Specify delivery sequence
Capability Transfer to Organization	None Identified

Inputs	Plan	Source	Make	Deliver	Return
Product Pull Signals			M	D	
Product Inventory Location		ES.4			
WIP Inventory Location			EM		
Finished Goods Inventory Location				ED	

Outputs	Plan	Source	Make	Deliver	Return
Inventory Availability	P2.2	ES.4	M1.2, M2.2, M3.3	D1.8, D4.2	
Daily Replenishment Requirements				D4.1	
Loaded Cart				D4.4	

Process Element: Authorize Supplier Payment	Process Element Number: S1.5
Process Element Definition	
The process of authorizing payments and paying suppliers for product or services. This process includes invoice collection, invoice matching and the issuance of checks.	
Performance Attributes	**Metric**
Reliability	% Invoices processed without issues and/or errors
Responsiveness	Authorize Supplier Payment Cycle Time
Flexibility	None Identified.
Cost	Cost per type of invoice.
Assets	None Identified
Best Practices	**Features**
Pay on Receipt	Electronic Invoice Processing

Inputs	Plan	Source	Make	Deliver	Return
Payment Terms		ES.9			

Outputs	Plan	Source	Make	Deliver	Return

S2: Source Make-to-Order Product

- (P1.4, P2.4) Sourcing Plans
- (ES.2), (M2.2) Source Execution Data
- (ES.6) Logistics Selection
- (M1.2, M2.2, M3.3, D2.3) Replenishment Signals
- (M1.1, M2.1, M3.2) Production Schedule
- (DR2.4) Return Inventory Transfer Data

S2.1

Schedule Product Deliveries

- Procurement Signal (Supplier)
- Sourced Product on Order (P2.2, ES.9)
- Scheduled Receipts (M1.1, M2.1, M3.2)
- Product on Order (D)

- (Supplier) Product
- (DR2.4) MRO Products

S2.2

Receive Product

- Receipt Verification (ES.1, ES.2, ES.6, ES.8)

S2.3

Verify Product

- Receipt Verification (ES.1, ES.2)

- (M) (D) Product Pull Signals
- (ES.4) Product Inventory Location
- (M) WIP Inventory Location
- (D) Finished Goods Inventory Location

S2.4

Transfer Product

- Inventory Availability (P2.2, M1.2, M2.2, M3.3, ES.4, D2.8)

- (ES.9) Payment Terms

S2.5

Authorize Supplier Payment

Process Category: Source Make-to-Order Product	Process Number: S2
Process Category Definition	
The procurement and delivery of product that is built to a specific design or configured based on the requirements of a particular customer order.	
Performance Attributes	**Metric**
Reliability	Perfect Order Fulfillment
Responsiveness	Source Cycle Time
Flexibility	Upside Source Flexibility Downside Source Adaptability Upside Source Adaptability
Cost	Product Acquisition Costs as % of Source (S2) Costs
Assets	Cash to Cash Cycle Time Return on Supply Chain Fixed Assets
Best Practices	**Features**
Joint Service Agreements	None Identified
Automated Statistical Process Control (SPC)	None Identified

Process Element: Schedule Product Deliveries	Process Element Number: S2.1
Process Element Definition	
Scheduling and managing the execution of the individual deliveries of product against the contract. The requirements for product deliveries are determined based on the detailed sourcing plan. This includes all aspects of managing the contract schedule including prototypes, qualifications or service deployment.	
Performance Attributes	**Metric**
Reliability	% Schedules generated within Supplier's Lead Time % Schedules changed within Supplier's Lead Time
Responsiveness	Schedule Product Deliveries Cycle Time
Flexibility	None Identified
Cost	Schedule Deliveries Costs as a % of Product Acquisition Costs
Assets	None Identified
Best Practices	**Features**
Utilize EDI transactions to reduce cycle time and costs	EDI interface for 830, 850, 856 & 862 transactions
Mechanical (Kanban) pull signals are used to notify suppliers of the need to deliver product	Electronic Kanban support
Consignment agreements are used to reduce assets and cycle time while increasing the availability of critical items	Consignment inventory management
Advanced ship notices allow for tight synchronization between SOURCE and MAKE processes	Blanket order support with scheduling interfaces to external supplier systems
Vendor Managed Inventory (VMI)	See Glossary

Inputs	Plan	Source	Make	Deliver	Return
Sourcing Plans	P1.4, P2.4				
Source Execution Data		ES.2	M2.2		
Logistics Selection			ES.6		
Replenishment Signals			M1.2, M2.2, M3.3	D2.3	
Production Schedule			M1.1, M2.1, M3.2		
Return Inventory Transfer Data					DR2.4

Outputs	Plan	Source	Make	Deliver	Return
Procurement Signal (Supplier)					
Sourced Product on Order	P2.2	ES.9			
Scheduled Receipts			M1.1, M2.1, M3.2		
Product on Order				D	

Process Element: Receive Product	Process Element Number: S2.2
Process Element Definition	
The process and associated activities of receiving product to contract requirements.	
Performance Attributes	**Metric**
Reliability	% Orders/ lines received damage free % Orders/ lines received complete % Orders/ lines received on-time to demand requirement % Orders/ lines received with correct shipping documents
Responsiveness	Receive Product Cycle Time
Flexibility	None Identified
Cost	Receiving costs as a % of Product Acquisition Costs
Assets	None Identified
Best Practices	**Features**
Supplier certification programs are used to reduce (skip lot) or eliminate receiving inspection	Skip lot / sampling inspection logic
Bar coding is used to minimize handling time and maximize data accuracy	Bar code interface for data collection devices Generate bar coded receiving documents
Deliveries are balanced throughout each working day and throughout the week	None Identified
Supplier delivers directly to point of use – (dock to line or end destination)	Electronic Tag tracking to Point of Use (POU) destination

Inputs	Plan	Source	Make	Deliver	Return
(Supplier) Product					
MRO Products					DR2.4

Outputs	Plan	Source	Make	Deliver	Return
Receipt Verification		ES.1, ES.2, ES.6, ES.8			

Process Element: Verify Product	Process Element Number: S2.3
Process Element Definition	
The process and actions required determining product conformance to requirements and criteria.	
Performance Attributes	**Metric**
Reliability	% Orders / lines received defect free
Responsiveness	Verify Product Cycle Time
Flexibility	None Identified
Cost	Verification costs as a % of Product Acquisition Costs
Assets	None Identified
Best Practices	**Features**
Supplier certification programs are used to reduce (skip lot) or eliminate receiving inspection	Skip lot/sampling inspection logic
Bar coding is used to minimize handling time and maximize data accuracy	Bar code interface for data collection devices Generate bar coded receiving documents
Deliveries are balanced throughout each working day and throughout the week	None Identified
Supplier delivers directly to point of use	Electronic Tag tracking to Point of Use (POU) destination
Supplier replaces defective material at customer's facility with good product as required.	Electronic Tag tracking to Point of Use (POU) destination

Inputs	Plan	Source	Make	Deliver	Return

Outputs	Plan	Source	Make	Deliver	Return
Receipt Verification		ES.1, ES.2			

Process Element: Transfer Product	Process Element Number: S2.4
Process Element Definition	
The transfer of accepted product to the appropriate stocking location within the supply chain. This includes all of the activities associated with repackaging, staging, transferring, and stocking product and or application of service.	
Performance Attributes	**Metric**
Reliability	% Product transferred damage free % Product transferred complete % Product transferred on-time to demand requirement % Product transferred without transaction errors
Responsiveness	Transfer Product Cycle Time
Flexibility	None Identified
Cost	Transfer & Product storage costs as a % of Product Acquisition Costs
Assets	Inventory DOS
Best Practices	**Features**
Drive deliveries directly to stock or point-of-use in manufacturing to reduce costs and cycle time Capability transfer to customer	Pay on receipt Specify delivery location and time (to the minute) Specify delivery sequence

Inputs	Plan	Source	Make	Deliver	Return
Product Pull Signals			M	D	
Product Inventory Location		ES.4			
WIP Inventory Location			M		
Finished Goods Inventory Location				D	

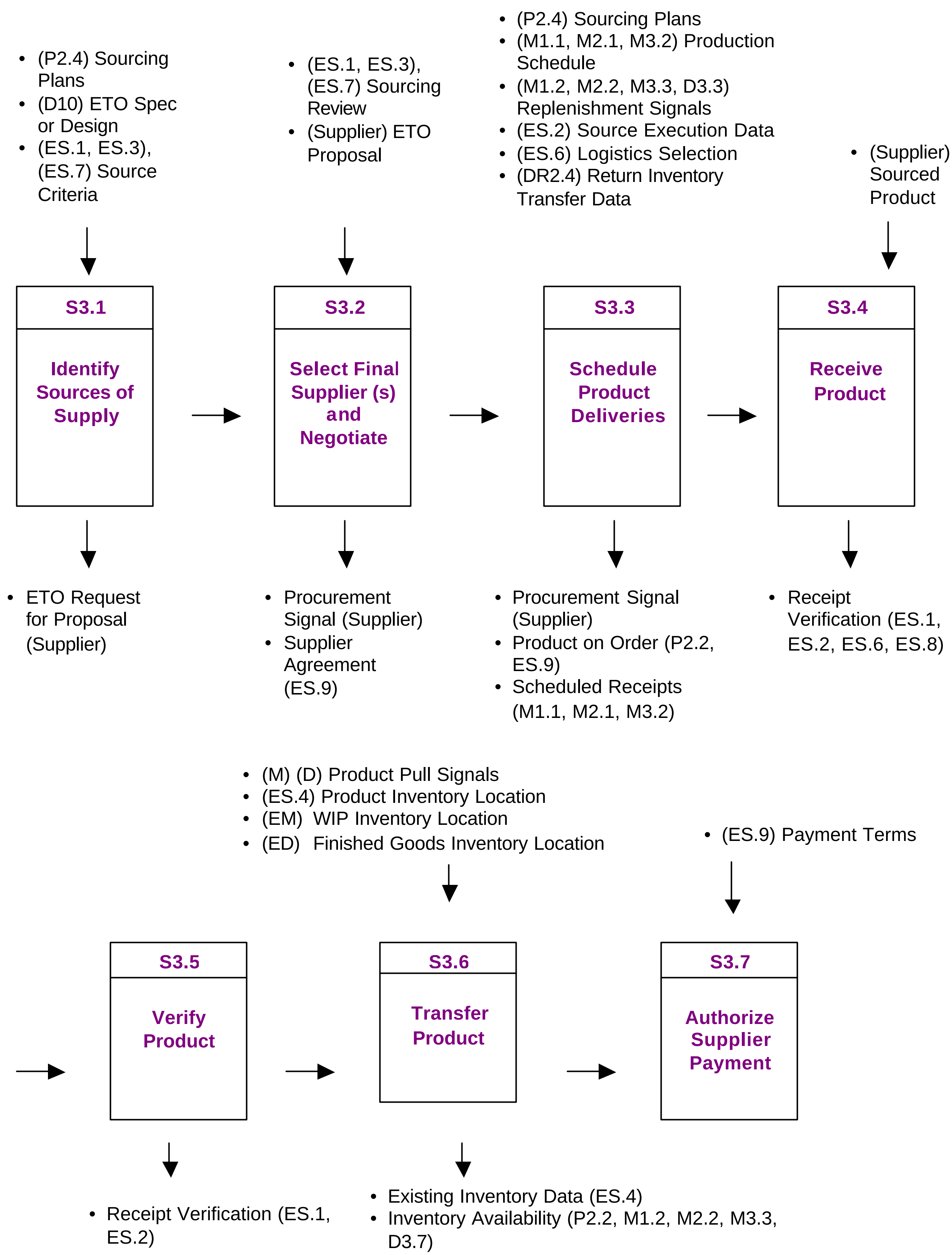
Outputs	Plan	Source	Make	Deliver	Return
Inventory Availability	P2.2.	ES.4	M1.2, M2.2, M3.3	D2.8	

Process Element: Authorize Supplier Payment	Process Element Number: S2.5
Process Element Definition	
The process of authorizing payments and paying suppliers for product or services. This process includes invoice collection, invoice matching and the issuance of checks.	
Performance Attributes	**Metric**
Reliability	% Invoices processed without issues and/or errors
Responsiveness	Authorize Supplier Payment Cycle Time
Flexibility	None Identified
Cost	Cost per type of invoice.
Assets	None Identified
Best Practices	**Features**
Pay on Receipt	Electronic Invoice Processing

Inputs	Plan	Source	Make	Deliver	Return
Payment Terms		ES.9			

Outputs	Plan	Source	Make	Deliver	Return

S3: Source Engineer-to-Order Product



Process Category: Source Engineer-to-Order Product	Process Number: S3
Process Category Definition	
The negotiation, procurement and delivery of engineer-to-order assemblies or specialized product or services that are designed and built based on the requirements or specifications of a particular customer order or contract.	
Performance Attributes	**Metric**
Reliability	Perfect Order Fulfillment
Responsiveness	Source Cycle Time
Flexibility	Upside Source Flexibility Downside Source Adaptability Upside Source Adaptability
Cost	Product Acquisition Costs as % of Source (S3) Costs
Assets	Cash to Cash Cycle Time Value of assets provided by service provider (cost avoidance) Return on Supply Chain Fixed Assets
Best Practices	**Features**
Joint Service Agreements	None Identified

Process Element: Identify Sources of Supply	Process Element Number: S3.1
Process Element Definition	
The identification and qualification of potential suppliers capable of designing and delivering product that will meet all of the required product specifications.	
Performance Attributes	**Metric**
Reliability	% Potential suppliers selected which become qualified % Qualified suppliers which meet defined requirements
Responsiveness	Identify Sources of Supply Cycle Time
Flexibility	None Identified
Cost	Source Identification Costs as a % of Product Acquisition Costs
Assets	Value of assets provided by service provider (cost avoidance)
Best Practices	**Features**
Product Data Management & Electronic Document Management are used to manage technical documents and requirements for engineer to order product	None Identified
Electronic data interchange is used to send technical information to and from potential suppliers	None Identified
On line RFQ processes linked into the document management process reduces cycle time and product management costs	None Identified
Concurrent engineering is used to tightly link sourcing into the product development process Make/Buy Decision Process (Outsourcing vs. In sourcing)	None Identified
Supplier development programs are used to get local suppliers to invest in developing new technologies	None Identified

Inputs	Plan	Source	Make	Deliver	Return
Sourcing Plans	P2.4				
ETO Spec or Design				D10	
Source Criteria		ES.1, ES.3, ES.7			

Outputs	Plan	Source	Make	Deliver	Return
ETO Request for Proposal (Supplier)					

Process Element: Select Final Supplier(s) and Negotiate	Process Element Number: S3.2
Process Element Definition	
The identification of the final supplier(s) based on the evaluation of RFQs, supplier qualifications and the generation of a contract defining the costs and terms and conditions of product availability.	
Performance Attributes	**Metric**
Reliability	% Supplier contracts negotiated meeting target terms and conditions for quality, delivery, flexibility and cost
Responsiveness	Select Supplier and Negotiate Cycle Time
Flexibility	None Identified
Cost	Supplier Selection Costs as a % of Product Acquisitions Costs
Assets	None Identified
Best Practices	**Features**
Electronic data interchange is used to send RFQs and technical information to and from potential suppliers	None Identified
On line RFQ processes linked into the document management process reduces cycle time and product management costs	None Identified
Supplier certification programs can reduce the cycle time for certifying existing suppliers to provide new technologies	None Identified
Utilize concurrent engineering with suppliers to allow them to provide engineering and product performance test data	None Identified
On line document management and automated supplier approval processes can reduce the cycle time and costs associated with managing supplier evaluations On-line availability to supplier financials	None Identified

Inputs	Plan	Source	Make	Deliver	Return
Sourcing Review		ES.1, ES.3, ES.7			
(Supplier) ETO Proposal					

Outputs	Plan	Source	Make	Deliver	Return
Procurement Signal (Supplier)					
Supplier Agreement		ES.9			

Process Element: Schedule Product Deliveries	Process Element Number: S3.3
Process Element Definition	
Scheduling and managing the execution of the individual deliveries of product against the contract. The requirements for product deliveries are determined based on the detailed sourcing plan. This includes all aspects of managing the contract schedule including prototypes and qualifications.	
Performance Attributes	**Metric**
Reliability	% Schedules generated within Supplier's Lead time % Schedules changed within Supplier's Lead time
Responsiveness	Schedule Product Deliveries Cycle Time
Flexibility	None Identified
Cost	Schedule Deliveries Costs as a % of Product Acquisition Costs
Assets	None Identified
Best Practices	**Features**
Utilize EDI transactions to reduce cycle time and costs	EDI interface for 830, 850, 856 & 862 transactions
Mechanical (Kanban) pull signals are used to notify suppliers of the need to deliver product	Electronic Kanban support
Consignment agreements are used to reduce assets and cycle time while increasing the availability of critical items	Consignment inventory management
Advanced ship notices allow for tight synchronization between SOURCE and MAKE processes	Blanket order support with scheduling interfaces to external supplier systems
Vendor Managed Inventory (VMI)	See Glossary

Inputs	Plan	Source	Make	Deliver	Return
Sourcing Plans	P2.4				
Production Schedule			M1.1, M2.1, M3.2		
Replenishment Signals			M1.2, M2.2, M3.3	D3.3	
Source Execution Data		ES.2			
Logistics Selection		ES.6			
Return Inventory Transfer Data					DR2.4

Outputs	Plan	Source	Make	Deliver	Return
Procurement Signal (Supplier)					
Product on Order	P2.2	ES.9			
Scheduled Receipts			M1.1, M2.1, M3.2		

Process Element: Receive Product	Process Element Number: S3.4
Process Element Definition	
The process and associated activities of receiving product to contract requirements.	
Performance Attributes	**Metric**
Reliability	% Orders/ lines received damage free % Orders/ lines received complete % Orders/ lines received on-time to demand requirement % Orders/ lines received with correct shipping documents
Responsiveness	Receive Product Cycle Time
Flexibility	None Identified
Cost	Receiving costs as a % of Product Acquisition Costs
Assets	None Identified
Best Practices	**Features**
Supplier certification programs are used to reduce (skip lot) or eliminate receiving inspection	Skip lot / sampling inspection logic
Bar coding is used to minimize handling time and maximize data accuracy	Bar code interface for data collection devices Generate bar coded receiving documents
Deliveries are balanced throughout each working day and throughout the week	None Identified
Supplier delivers directly to point of use – (dock to line or end destination)	Electronic Tag tracking to Point of Use (POU) destination

Inputs	Plan	Source	Make	Deliver	Return
(Supplier) Sourced Product					

Outputs	Plan	Source	Make	Deliver	Return
Receipt Verification		ES.1, ES.2, ES.6, ES.8			

Process Element: Verify Product	Process Element Number: S3.5
Process Element Definition	
The process and actions required determining product conformance to requirements and criteria.	
Performance Attributes	**Metric**
Reliability	% Orders / lines received defect free
Responsiveness	Verify Product Cycle Time
Flexibility	None Identified
Cost	Verification costs as a % of Product Acquisition Costs
Assets	None Identified
Best Practices	**Features**
Supplier certification programs are used to reduce (skip lot) or eliminate receiving inspection	Skip lot/sampling inspection logic
Bar coding is used to minimize handling time and maximize data accuracy	Bar code interface for data collection devices Generate bar coded receiving documents
Deliveries are balanced throughout each working day and throughout the week	None Identified
Supplier delivers directly to point of use	Electronic Tag tracking to Point of Use (POU) destination
Supplier replaces defective material at customer's facility with good product as required.	Electronic Tag tracking to Point of Use (POU) destination

Inputs	Plan	Source	Make	Deliver	Return

Outputs	Plan	Source	Make	Deliver	Return
Receipt Verification		ES.1, ES.2			

Process Element: Transfer Product	Process Element Number: S3.6
Process Element Definition	
The transfer of accepted product to the appropriate stocking location within the supply chain. This includes all of the activities associated with repackaging, staging, transferring, and stocking product.	
Performance Attributes	**Metric**
Reliability	% Product transferred damage free % Product transferred complete % Product transferred on-time to demand requirement % Product transferred without transaction errors
Responsiveness	Transfer Product Cycle Time
Flexibility	None Identified
Cost	Transfer & Product storage costs as a % of Product Acquisition Costs
Assets	Inventory DOS
Best Practices	**Features**
Drive deliveries directly to stock or point-of-use in manufacturing to reduce costs and cycle time	Pay on receipt Specify delivery location and time (to the minute) Specify delivery sequence
Capability Transfer to organization	None Identified

Inputs	Plan	Source	Make	Deliver	Return
Product Pull Signals			M	D	
Product Inventory Location		ES.4			
WIP Inventory Location			EM		
Finished Goods Inventory Location				ED	

Outputs	Plan	Source	Make	Deliver	Return
Existing Inventory Data		ES.4			
Inventory Availability	P2.2		M1.2, M2.2, M3.3	D3.7	

Process Element: Authorize Supplier Payment	Process Element Number: S3.7
Process Element Definition	
The process of authorizing payments and paying suppliers for product or services. This process includes invoice collection, invoice matching and the issuance of checks.	
Performance Attributes	**Metric**
Reliability	% Invoices Processed without Issues and/or Errors
Responsiveness	Authorize Supplier Payment Cycle Time
Flexibility	None Identified
Cost	Cost per type of invoice.
Assets	None Identified
Best Practices	**Features**
Pay on Receipt	Electronic Invoice Processing

Inputs	Plan	Source	Make	Deliver	Return
Payment Terms		ES.9			

Outputs	Plan	Source	Make	Deliver	Return

ES: Enable Source

- (S1.2, S1.3, S2.2), (S2.3, S3.4, S3.5) Receipt Verification
- (ES.7) Manage Supplier Network

ES.1

Manage Sourcing Business Rules

- Manage Supplier Network (ES.7)
- Identify Source of Supply (S3.1, S3.2)

- (S1.2, S1.3, S2.2), (S2.3, S3.4, S3.5) Receipt Verification
- (ES.7) Manage Supplier Network

ES.2

Assess Supplier Performance

- Maintain Source Data (ES.3)
- Manage Supplier Network (ES.7)
- Establish Source Plan (S1.1, S2.1, S3.3,)

- Plan Source
- Manage Supply Chain Inventory
- (ES.2) Quality & Delivery Performance
- (ES.7) Manage Supplier Network

ES.3

Maintain Source Data

- Manage Supplier Network (ES.7)
- Identify Source of Supply (S3.1, S3.2)
- Current Inventory Source Data

- Product Mix and Plans
- Supply Chain Plan
- Inventory and Order Rules
- Parts and Services Consumed
- (S1.4, S2.4, S3.6) Existing Inventory Data

ES.4

Manage Product Inventory

- Product Inventory Location (S1.4, S2.4, S3.6)
- MRO Parts Availability
- Inventory Target Levels (P2.2)
- Supply Chain Performance (P2.2)
- Inventory Availability (SR2.3, SR2.4, SR2.5)

- (ES.8) Import/Export Requirements
- (ES.9) Supplier Agreement
- Parts and Services Consumed
- Deliver Capital Assets

ES.5

Manage Capital Assets

- Import/Export Requirements (ES.8)

- (ES.8) Contract Carrier Rates
- (S1.2, S2.2, S3.4) Receipt Verification

ES.6

Manage Incoming Product

- Logistics Selection (S1.1, S2.1, S3.3)

ES: Enable Source

- (ES.1) Business Rules
- (ES.2) Supplier Performance
- (ES.3) Incoming Product
- (ES.9) Supplier Agreement

ES.7

Manage Supplier Network

- Business Rules (ES.1)
- Supplier Performance (ES.2)
- Incoming Product (ES.3)
- Supplier Agreement (ES.9)
- Identify Sources (S3.1, S3.2)

- (S1.2), S2.2, S3.4) Receipt History
- (ES.5) Manage Capital Assets
- Parts and Services Consumed

ES.8

Manage Import/Export Requirements

- Manage Capital Assets (ES.5)
- Manage Incoming Product (ES.6)
- Supplier Agreement (ES.9)

- (S3.2) Select Final Supplier & Negotiate
- (ES.7) Manage Supplier Network
- (S1.1, S2.1, S3.3) Schedule Product Deliveries
- (ES.8) Import/Export Requirements

ES.9

Manage Supplier Agreements

- Manage Capital Assets (ES.5)
- Manage Supplier Network (ES.7)
- Authorize Supplier Payment (S1.5, S2.5, S3.7)

Enable Process: Manage Sourcing Business Rules	Process Number: ES.1
Enable Process Definition	
The process of defining requirements and establishing, maintaining and enforcing decision support criteria, in alignment with business strategy, goals and objectives. The business strategy defines the criteria for sourcing business rules that are translated into guidelines and policies for conducting business within the enterprise and other legal entities. Sourcing business rules include: supplier selection and negotiation processes, fulfillment and delivery performance and relationship definition for specific levels of collaboration and partnership.	
Performance Attributes	**Metric**
Reliability	% Agreements Negotiated without error/change requirement % Orders placed without error The Degree & Frequency of Conformance to Business Rules that is achieved
Responsiveness	None Identified
Flexibility	None Identified
Cost	Cost of Process Documentation, Monitoring and Auditing Business Rules Cost of non-compliance to Business Rules
Assets	Assets as a % of cost to administer business rules
Best Practice	**Features**
Enterprise level policies/rules with local execution	Web based access to enterprise level business rules
Long term supplier agreements/partnerships	Electronic rules for business relationships and transactions
Optimized Supply Chain Processes Optimized Supplier Count Supplier and Part Rationalization	Web based access to preferred and recommended suppliers, supplier performance data & spend data stratified by commodity, business unit/site, supplier, part type, process type
Enterprise level spend analysis	Web based access to current spend data available from enterprise to part level
Collaborative review and agreement of business rules prior to contract execution	Use of WEB enabled conferencing or meeting software for review
Electronic Sourcing and Negotiation	Business Rules for electronic sourcing process and hierarchy

Inputs	Plan	Source	Make	Deliver	Return
Receipt Verification		S1.2, S1.3, S2.2, S2.3, S3.4, S3.5			
Manage Supplier Network		ES.7			

Outputs	Plan	Source	Make	Deliver	Return
Manage Supplier Network		ES.7			
Identify Source of Supply		S3.1, S3.2			

Enable Process: Assess Supplier Performance	Process Number: ES.2
Enable Process Definition	
The process of measuring actual supplier performance against internal and/or external standards, providing feedback to achieve and maintain the performance required to meet the customers' business and/or competitive needs.	
Performance Attributes	**Metric**
Reliability	On-time delivery performance (required quantities, to dates required) Defective product (expressed as % or defective parts per million) Performance to requirements stated in contracts or service agreements Continuous improvement trends or patterns Business performance trends or patterns Frequency of personnel changes and related impacts Supplier Performance Rating Quality Improvement Productivity Improvement
Responsiveness	None Identified
Flexibility	None Identified
Cost	Cost to measure supply base performance as a % of revenue Total cost of nonconformance as a % of revenue Costs related to specific types of non-conformance
Assets	Assets as a % of Non-conformance Costs
Best Practice	**Features**
Performance expectations and business rules are clearly communicated prior to the initiation of business with the supplier	Web based access / availability to business rules and performance criteria
Supplier performance data is collected, analyzed and reported to suppliers online and real-time through extranet applications	Web based relational database / management application
Supplier "cost of nonconformance" data is collected, analyzed and used in performance reporting	Software application to automate data collection and reporting
Comparative analysis of supplier performance is used in sourcing decisions	Software application with data analysis capability
Suppliers are evaluated, selected and qualified with criteria matched to business requirements and competitive needs	None identified
Cost reduction and or cost avoidance are opportunities are identified, implemented and measured on a periodic basis	
Continuous Improvement and development is driven and measured through the performance review process	
Supplier (Carrier) Agreements	See Glossary
Assess Supplier Performance	See Glossary

Inputs	Plan	Source	Make	Deliver	Return
Receipt Verification		S1.2, S1.3, S2.2, S2.3, S3.4, S3.5			
Manage Supplier Network		ES.7			

Outputs	Plan	Source	Make	Deliver	Return
Maintain Source Data		ES.3			
Manage Supplier Network		ES.7			
Establish Source Plan		S1.1, S2.1, S3.3			

Enable Process: Maintain Source Data	Process Number: ES.3
Enable Process Definition	
The process of collecting, sorting, defining hierarchy and managing configuration control of supplier information and source data that are required to make sourcing and related planning and manufacturing decisions. Source data to be maintained includes supplier profile data, financials, quality and delivery performance, spend analysis at various levels of the enterprise, from major business units to material part number	
Performance Attributes	**Metric**
Reliability	Availability &Accuracy of supplier/source data Frequency of supplier/source data update feeds
Responsiveness	None Identified
Flexibility	None Identified
Cost	Cost of maintaining source data as a % of spend, % revenue
Assets	Assets as a % of cost to maintain data repository
Best Practice	**Features**
Data accessibility across the enterprise for visibility by discrete business units	Web based access to various levels of enterprise data
On demand access of supplier/source data	Web based access to current supplier/source data
Automated update of supplier performance information	None Identified
Supplier and material rationalization	Web based access to supplier/source data

Inputs	Plan	Source	Make	Deliver	Return
Plan Source, Manage Supply Chain Inventory					
Quality & Delivery Performance		ES.2			
Manage Supplier Network		ES.7			

Outputs	Plan	Source	Make	Deliver	Return
Current Inventory Source Data					
Manage Supplier Network		ES.7			
Identify Source of Supply		S3.1, S3.2			

Enable Process: Manage Product Inventory	Process Number: ES.4
Enable Process Definition	
The process of establishing and maintaining physical inventories and inventory information. This includes warehouse management, cycle counting, physical inventories and inventory reconciliation. For Services, this may include tracking the number of service providers and the financial resources committed at any given point in time.	
Performance Attributes	**Metric**
Reliability	Fill Rate (% filled of an order)
Responsiveness	None Identified
Flexibility	None Identified
Cost	Inventory carrying cost Days of Supply (DOS) Inventory Value (measured in dollars) Inventory Management Costs as % of (S+M) Costs
Assets	Inventory Days of Supply
Best Practice	**Features**
Periodic review of metrics and strategy with comparisons to industry benchmarks	Real time view of data.
Real time data on current status.	Dynamic calculation of safety stock based on actual sales
Supplier Managed Inventory	The supplier is responsible for maintaining inventory levels at the point of use. The software system verifies usage, receiving and payment functions.
Inventory Cycle Counting	See Glossary

Inputs	Plan	Source	Make	Deliver	Return
Product Mix and Plans, Supply Chain Plan, Inventory and Order Rules					
Existing Inventory Data		S1.4, S2.4, S3.6			
Parts and Services Consumed					

Outputs	Plan	Source	Make	Deliver	Return
Product Inventory Location		S1.4, S2.4, S3.6			
MRO Parts Availability					
Inventory Target Levels, Supply Chain Performance	P2.2				
Inventory Availability					SR2.3, SR2.4, SR2.5

Enable Process: Manage Capital Assets	Process Number: ES.5
Enable Process Definition	
The process of acquiring, maintaining and dispositioning an organization's <capital assets> located at a supplier's facility and/or outside source, which are used to operate the supply chain.	
Performance Attributes	**Metric**
Reliability	Unplanned Maintenance Downtime % of Total Production Time % Obsolete or Inactive Capital Assets
Responsiveness	None Identified
Flexibility	None Identified
Cost	Cost of Damaged Capital Asset Cost of Obsolete Capital Asset Capital Asset Carrying Cost
Assets	Actual Asset Life Maintenance Cost as % of Replacement Value Source Fixed Asset Costs
Best Practice	**Features**
Removal of Obsolete Capital Assets	Automated Calculation of ABC Velocity Movement
Total Preventative Maintenance Program	Automatically generated TPM repair schedules integrated with MRP systems, electronic equipment repair history, parts listings, part stores inventory & reorder points, automatic store room parts purchases, Shop floor access to electronic data base of equipment line drawings, electrical wiring diagrams, parts listing reference guide and part cost lists.
Changeover Reduction / Continuous Improvement Program	Changeover process flow element identification, instructional directions to conduct changeover, and measurement tool that can be used to prioritize and track results of improvement efforts. Software to identify operational constraints to the MAKE processes of the Supplier to assist in directing resources toward bottleneck functional areas.
Facility & Equipment Environmental / Safety Audit System	System software to list checklist items, report results of audit & forward actions to be taken
Inventory Cycle Counting	See Glossary

Inputs	Plan	Source	Make	Deliver	Return
Import/Export Requirements		ES.8			
Supplier Agreement		ES.9			
Parts and Services Consumed					
Deliver Capital Assets					

Outputs	Plan	Source	Make	Deliver	Return
Import/Export Requirements		ES.8			

Enable Process: Manage Incoming Product	Process Number: ES.6
Enable Process Definition	
The process of defining and maintaining the information that characterizes inbound logistics management of all supplier deliveries, including both physical and electronic goods and services. This includes carrier selection and management, tracking deliveries and import.	
Performance Attributes	**Metric**
Reliability	Frequency of parameter updates Number of data sources for data collection
Responsiveness	None Identified
Flexibility	None Identified
Cost	Data maintenance costs as % of Source Costs
Assets	Empty-to-loaded back-haul mile index Equipment utilization rates (hours) Equipment utilization rates (product contribution margin) Vehicle maintenance costs
Best Practice	**Features**
Integrated Order Management, Warehouse Management and Transportation Management Systems View for analysis for all orders and shipments the following data: Logistics, Product, Cost, GL Charging Appointment Scheduling for Pickup and Delivery of Customer Shipments Measurement of Carrier Performance for On-time Delivery and Completeness Real-time Optimized Shipment Method Selection (Air Parcel, Ground Parcel, LTL, etc.) Based on Customer Service Requirements Real-time Shipment Tracking, (via Internet) Electronic Manifest and Electronic Billing Automated Documentation for International Shipments Manage Information across 100% of shipments Capture and maintain mode specific data	Transportation Management System (TMS) Maintenance Management
Internet Pooling (Electronic brokerage of shipments	Rating & Routing
Back-haul trading exchange	Pooling

Inputs	Plan	Source	Make	Deliver	Return
Contract Carrier Rates		ES.8			
Receipt Verification		S1.2, S2.2, S3.4			

Outputs	Plan	Source	Make	Deliver	Return
Logistics Selection		S1.1, S2.1, S3.3			

Enable Process: Manage Supplier Network	Process Number: ES.7
Enable Process Definition	
The process of defining and maintaining a unique network of suppliers to deliver a specific product set. This includes establishment of a new supplier or maintaining an existing supplier and all the tasks and activities associated with identifying and qualifying the supplier and finalizing on the sourcing terms and conditions. Also, the management of a supplier certification process, which includes certifying new suppliers and maintaining the current status of existing suppliers.	
Performance Attributes	**Metric**
Reliability	Supplier Delivery Performance Percent Supplier Quality Performance Percent Supplier Price Performance Percent
Responsiveness	None Identified
Flexibility	None Identified
Cost	None Identified
Assets	Value of assets provided by service provider (cost avoidance)
Best Practice	**Features**
Internet Exchanges that provide: Catalog hosting services allow suppliers to edit, review and publish their catalog content to the Exchange hosted catalog. Exchanges also offers value add services that help suppliers differentiate their content, optimize catalogs for maximum order volume as well as manage individual trading relationships with buyers. Spot Purchasing allows buyers to search the Exchange hosted catalog and compare the goods and services offered by multiple suppliers. Buyers can add items selected for purchase to their shopping cart. Suppliers are automatically notified of the purchases when the buyer 'checks-out' with the shopping cart. Buyer Auctions allow buyers to create and publish an auction for goods and services that they intend to purchase. Bids from multiple suppliers can then be compared to make an award decision. In this way, buyers can quickly identify new sources of supply and manage unexpected changes in demand. Seller Auctions allow sellers to create and publish an auction for goods or services that they intend to sell. The seller can review and compare bids from multiple buyers to make an award decision. Suppliers can easily manage excess capacity as well as maximize the value of obsolete or scrap materials. Transaction Delivery services allow buyers and suppliers to connect seamlessly to Exchanges to send and receive purchasing transactions securely over the Internet.	Internet Exchanges are a hosted, business-to-business trading network. Exchanges are an open procurement network, accessible to any buyer and focused on new Internet-enabled purchasing models like spot buys or reverse, buyer-driven auctions. Exchanges will also support more traditional catalog-based sales.
Identification of suppliers who will participate in Consignment Inventory programs	Consignment Inventory Management
Identification of suppliers who will participate in Kanban programs	Electronic Kanban Support

Identification of suppliers who will participate in procurement split (two or more suppliers sharing purchase requirements) programs	None Identified
Electronic data interchange can be used to send RFQs and technical information to and from potential suppliers to determine supplier capability to fulfill requirements so that they may be added to supplier network	Electronic Data Interchange
On-line availability to supplier financials to determine potential supplier viability to be added to supplier network	Internet web sites for financial evaluation
Utilize concurrent engineering with suppliers to allow them to provide engineering and product performance test data to qualify as part of potential supplier network	Internet, EDI, FAX
On line document management and automated supplier approval processes can reduce the cycle time and costs associated with managing supplier evaluations and get them into the supplier network faster	ERP
Supplier certification programs can reduce the cycle time for initial certification of new suppliers or certifying existing suppliers that wish to provide new technologies	None Identified
Establishment of criteria to rank suppliers	Utilize supplier delivery, quality, price performance as well as any other criteria such as terms and conditions
Evaluate supplier network for duplicates	Supplier Merge Programs for duplicates
Supplier (Carrier) Agreements	See Glossary
Vendor Managed Inventory (VMI)	See Glossary

Inputs	Plan	Source	Make	Deliver	Return
Business Rules		ES.1			
Supplier Performance		ES.2			
Incoming Product		ES.3			
Supplier Agreement		ES.9			

Outputs	Plan	Source	Make	Deliver	Return
Business Rules		ES.1			
Supplier Performance		ES.2			
Incoming Product		ES.3			
Supplier Agreement		ES.9			
Identify Sources		S3.1, S3.2			

Enable Process: Manage Import/Export Requirements	Process Number: ES.8
Enable Process Definition	
The process of identifying and complying with import/export regulatory documentation and process standards set by external entities (eg, government).	
Performance Attributes	**Metric**
Reliability	Compliance with multi-country government regulations Minimized delays in-transit caused by customs intervention
Responsiveness	None Identified
Flexibility	None Identified
Cost	Duty tax control Cost of compliance
Assets	None Identified
Best Practice	**Features**
Documents generated automatically during shipment preparation. Direct connection to customs clearance Direct Transfer of documents to Recipient and Forwarder	Electronic documentation submission via EDI and/or Internet
Assessing export/import requirements during time of product development/manufacture	Multi-country Export/Import documentation compliance
Ability to track component/sub-component manufacturing country of origin	Component/lot tracking (lot trace-ability)

Inputs	Plan	Source	Make	Deliver	Return
Receipt History		S1.2, S2.2, S3.4			
Manage Capital Assets		ES.5			
Parts and Services Consumed					

Outputs	Plan	Source	Make	Deliver	Return
Manage Capital Assets		ES.5			
Manage Incoming Product		ES.6			
Supplier Agreement		ES.9			

Enable Process: Manage Supplier Agreements	Process Number: ES.9
Enable Process Definition	
The management of existing purchase orders or supplier contracts. This includes managing volume/step pricing, resolving issues, enforcing terms and conditions and maintaining an accurate status for existing purchase orders or contracts.	
Performance Attributes	**Metric**
Reliability	Supplier Delivery Performance Percent Supplier Quality Performance Percent Supplier Price Performance Percent Re-negotiation Cycle Time Volume of Amendment compared to total contracts
Responsiveness	None Identified
Flexibility	None Identified
Cost	Cost of managing Long Term Agreements as a % spent, % revenue Cost of managing All Contracts as a % spent, % revenue
Assets	Assets associated with the Management of Supplier Agreements as a %of Total Assets.
Best Practice	**Features**
Enterprise level policies/rules with local execution	Web based access to enterprise level business rules
Long term supplier agreements/partnerships Vendor Managed Inventory Agreements Fab & Hold Agreements Just-In-Time Agreements	Electronic rules for business relationships and transactions
Optimized Supply Chain Processes Optimized Supplier Count Supplier and Part Rationalization	Web based access to preferred and recommended suppliers, supplier performance data and spend data stratified by commodity, business unit/site, supplier, part type, process type
Enterprise level spend analysis	Web based access to current spend data available from enterprise to part level
Electronic Sourcing and Negotiation E-Business	Business Rules for electronic sourcing process and hierarchy
Supplier (Carrier) Agreements	See Glossary

Inputs	Plan	Source	Make	Deliver	Return
Select Final Supplier & Negotiate		S3.2			
Manage Supplier Network		ES.7			
Schedule Product Deliveries		S1.1, S2.1, S3.3			
Import/Export Requirements		ES.8			

Outputs	Plan	Source	Make	Deliver	Return
Manage Capital Assets		ES.5			
Manage Supplier Network		ES.7			
Authorize Supplier Payment		S1.5, S2.5, S3.7			

M1: Make-to-Stock

- (P3.4) Production Plan
- (S1.1, S2.1, S3.3) Scheduled Receipts
- (M1.2, M1.3, M1.4, M1.5, M1.6) Information Feedback
- (EM.5) Equipment and Facilities Schedules and Plans

M1.1

Schedule Production Activities

- Production Schedule (P3.2, S1.1, S2.1, S3.3, D1.3, D1.8, D4.2)

- (S1.4, S2.4, S3.6) Inventory Availability
- (EM.4) WIP Handling Rules, Move Information and Methods
- (EM.6) WIP Location Rules

M1.2

Issue Product

- Inventory Availability (P3.2)
- Information Feedback (M1.1)
- Replenishment Signal (S1.1, S2.1, S3.3)
- Product Location Information (EM.6)

M1.3

Produce and Test

- Information Feedback (M1.1)

M1.4

Package

- Information Feedback (M1.1)

- (P3.4) Production Plan
- (P4.4) Deliver Plan

M1.5

Stage Product

- Information Feedback (M1.1)

M1.6

Release Product to Deliver

- Information Feedback (M1.1)
- Finished Product Release (D1.8, D4.2)

Process Category: Make-to-Stock	Process Number: M1
Process Category Definition	
The process of manufacturing in a make-to-stock environment adds value to products through mixing, separating, forming, machining, and chemical processes. Make to stock products are intended to be shipped from finished goods or “off the shelf,” are completed prior to receipt of a customer order, and are generally produced in accordance with a sales forecast.	
Performance Attributes	**Metric**
Reliability	Perfect Order Fulfillment
Responsiveness	Make Cycle Time
Flexibility	Upside Make Flexibility Downside Make Adaptability Upside Make Adaptability
Cost	Plant Operating Cost per Hour Indirect to Direct Headcount Ratio Cost\unit Indirect To Direct Process Cost Ratio Product Losses (Sourced/In-Process/Finished)
Assets	Cash to Cash Cycle Time Inventory Aging Return on Supply Chain Fixed Assets
Best Practices	**Features**
Cellular manufacturing	Manufacturing is broken into work cells
Demand-pull manufacturing, including active reduction of manufacturing system time and WIP through the use of demand-pull mechanisms and visual controls	Support for demand-pull mechanisms (Kanban, replenishment signals, ETC.) based on rate schedules and user defined minimum and maximum trigger points.
Performance results that are compared to benchmarks (i.e., capacity, scheduling) and readily available to employees.	Data warehouse, report writing, real time database and Executive Information systems that are easily accessible. Use of web-based technologies for dissemination of information
Organization to enhance flexibility: Few job classifications, self-directed work force, flat management structure, and cross-functional work teams.	Support for modular skills inventory with links to training databases, compensation systems, and operator instructions.
Paperless production order and inventory tracking	Electronic dispatch and data collection. Allow customer access to production status and inventories using internet technologies and web site features.
Link individual performance to organizational and divisional goals	None Identified
Provide continuous formal training to employees	Examples would be TQM, Six Sigma
Implement employee involvement programs	Postponement of final configuration to the nearest point to the customer. EG. Do configuration at warehouse.
Migrate from build to stock to configure to order; build subassemblies to forecast at the highest generic level in the bill of material/recipe/formula.	None Identified
Accurate and low cost batch/configuration records for warranty and regulatory tracking	Electronic batch/configuration records
Production level loading	Capacity planning

Lean Manufacturing	Use a team based systematic approach to identifying and eliminating wasteful, or non-value adding, activities within your manufacturing organization.
Vendor Managed inventory	Allows optimum use of production capacity and reduces inventory. Use internet technologies to provide the required business-to-business interfaces.
Accurate and approved work instructions/ process plans	Electronic document management that maintains current Standard operation procedures (SOPs)

Process Element: Schedule Production Activities	Process Element Number: M1.1
Process Element Definition	
Given plans for the production of specific parts, products, or formulations in specified quantities and planned availability of required sourced products, the scheduling of the operations to be performed in accordance with these plans. Scheduling includes sequencing, and, depending on the factory layout, any standards for setup and run. In general, intermediate production activities are coordinated prior to the scheduling of the operations to be performed in producing a finished product.	
Performance Attributes	**Metric**
Reliability	Schedule achievement
Responsiveness	Schedule Production Activities Cycle Time
Flexibility	None Identified
Cost	WIP inventory days of supply Scheduling resource costs as % of Make costs
Assets	Capacity utilization
Best Practices	**Features**
Cross training/Certification	HR/Certification support
Maintain data and system integrity by ensuring production data, inventory levels, and schedule requirements are 99+% accurate	Detailed production model that synchronizes PLAN and MAKE activities in real time.
Schedule optimizes use of shared resources, such as production equipment and tooling	Detailed production scheduling model and simulation capabilities
Schedule includes preventive maintenance program	Interface between maintenance management system and scheduling system
Schedule minimizes changeover costs	Detailed production scheduling model and simulation capabilities
Real-time feedback from Production, raw material and finished goods inventory and test activities.	Allow dynamic re-synchronization of MAKE activities by tying in real time status information to scheduler.
Provide scheduling output back to material and labor planning systems.	Accurate, real time information.
Drum-Buffer-Rope Scheduling Technique	See Glossary

Inputs	Plan	Source	Make	Deliver	Return
Production Plan	P3.4				
Scheduled Receipts – depends upon the type of sourced product required. The item sourced could be from a vendor's make-to-stock process, make-to-order, or engineer-to-order process.		S1.1, S2.1, S3.3			
Information Feedback			M1.2, M1.3, M1.4, M1.5, M1.6		
Equipment and Facilities Schedules and Plans			EM.5		

Outputs	Plan	Source	Make	Deliver	Return
Production Schedule - information is used as feedback for Plan and Source support processes. Projection of inventory availability for Deliver planning also requires the production schedule as feedback information.	P3.2	S1.1, S2.1, S3.3		D1.3, D1.8, D4.2	

Process Element: Issue Material	Process Element Number: M1.2
Process Element Definition	
The selection and physical movement of sourced/in-process product (e.g., raw materials, fabricated components, subassemblies, required ingredients or intermediate formulations) from a stocking location (e.g., stockroom, a location on the production floor, a supplier) to a specific point of use location. Issuing product includes the corresponding system transaction. The Bill of Materials/routing information or recipe/production instructions will determine the products to be issued to support the production operation(s).	
Performance Attributes	**Metric**
Reliability	Inventory accuracy Out of stock occurrences
Responsiveness	Issue Material Cycle Time
Flexibility	None Identified
Cost	Inventory obsolescence Inventory days supply - sourced product, in-process product
Assets	None Identified
Best Practices	**Features**
Strategic safety stock of selected materials, items, or subassemblies to decouple sourced product issuance cycle time from supplier lead time	Use of safety stock algorithms to minimize stock levels.
Electronic material move transactions	Automated process control and/or barcode data collection
Back flush material at order completion	Flexible back flush logic
Complete lot history	Inventory by lot of sourced/in-process product or discrete order, / usage reporting by lot or discrete order
Demand-pull mechanisms; Kanban replenishment signals from stockroom, intermediate products, or subassembly area	None Identified
Supplier delivery to production process at point of use	EDI link to supplier's sales order and inventory systems

Inputs	Plan	Source	Make	Deliver	Return
Inventory Availability		S1.4, S2.4, S3.6			
WIP Handling Rules, Move Information and Methods			EM.4		
WIP Location Rules			EM.6		

Outputs	Plan	Source	Make	Deliver	Return
Inventory Availability	P3.2				
Information Feedback			M1.1		
Replenishment Signal		S1.1, S2.1, S3.3			
Sourced Product Location Information			EM.6		

Process Element: Produce and Test	Process Element Number: M1.3
Process Element Definition	
The series of activities performed upon sourced/in-process product to convert it from the raw or semi-finished state to a state of completion and greater value. The processes associated with the validation of product performance to ensure conformance to defined specifications and requirements.	
Performance Attributes	**Metric**
Reliability	Fill rates Ratio of actual to theoretical cycle time Warranty and returns Yields Scrap expense In-process failure rates
Responsiveness	Produce and Test Cycle Time
Flexibility	None Identified
Cost	Total Production Employment Value Added Productivity Warranty Costs as % of (S+M+D) costs Production and Test costs / unit
Assets	Capacity utilization Asset Turns
Best Practices	**Features**
Authorize each operation to assess the quality of the previous operations	None Identified
Paperless production control	Electronic dispatch of operations
Accurate and approved process plans/specifications	Electronic document management
Reduce chances of operator error	Automatic download of production equipment with batch recipes/part programs
Measuring process metrics and feedback to operators	Electronic data collection of completion, quality, scrap, labor and equipment data and dissemination of information on factory floor
Reduce non-value added activities, including queue, move, and set-up times	Use principals of Lean Manufacturing
Accurate batch/configuration records for warranty and regulatory tracking	Electronic batch recording/configuration
Just-in-time demand flow techniques	Demand-pull mechanisms
Design/upgrade production equipment to maximize flexibility and avoid line stoppages	Machine productivity and downtime monitoring
Real time quality control techniques	Electronic collection of quality data and online SPC
Maintain accurate lot/batch history information	Electronic data collection of employee actions and sourced/in-process product lot used

Inputs	Plan	Source	Make	Deliver	Return

Outputs	Plan	Source	Make	Deliver	Return
Information Feedback			M1.1		

Process Element: Package	Process Element Number: M1.4
Process Element Definition	
The series of activities that containerize completed products for storage or sale to end-users. Within certain industries, packaging may include cleaning or sterilization.	
Performance Attributes	**Metric**
Reliability	Warranty costs
Responsiveness	Package Cycle Time
Flexibility	None Identified
Cost	Packaging cost as % of Make cost Scrap packaging expense
Assets	Asset turns Capacity utilization
Best Practices	**Features**
Design/upgrade production equipment to maximize flexibility and avoid line stoppages	Machine productivity and downtime monitoring
Accurate and approved process plans, routings, specifications and procedures	Electronic document management
Up-to-date shop packet/specification for each unique production event/demand	Electronic Work Instructions
Paperless production control	Electronic dispatch of operations
Minimize operator induced errors	Automatic download of production equipment with setup parameters Graphical display of setup/changeover/layout
Reduce non-value added paperwork while still maintaining process metrics	Electronic data collection of completion, quality, lot trace ability, scrap, and labor data
Packaging operation is an integral part of the overall production process	None Identified
Accurate and low cost batch/configuration records for warranty and regulatory tracking	Electronic batch/configuration records
Automatic label and seal verification	Automatic interface to inspection systems

Inputs	Plan	Source	Make	Deliver	Return

Outputs	Plan	Source	Make	Deliver	Return
Information Feedback			M1.1		

Process Element: Stage Finished Product	Process Element Number: M1.5
Process Element Definition	
The movement of packaged products into a temporary holding location to await movement to a finished goods location. Products that are made to order may remain in the holding location to await shipment per the associated customer order. The movement to finished goods is part of the Deliver process.	
Performance Attributes	**Metric**
Reliability	Staging time
Responsiveness	Stage Finished Product Cycle Time
Flexibility	None Identified
Cost	Inventory Carrying Cost
Assets	WIP days of supply
Best Practices	**Features**
Direct ship from factory to customer/channel	Share production status with customers and transportation providers via web-based tools. Auto-Tendering for direct ship utilizing EDI/XML protocols.
Electronic material move transactions	Bar code data collection

Inputs	Plan	Source	Make	Deliver	Return
Production Plan, Deliver Plan as they influence where you stage product due to size of production runs or timing of expected release to Delivery	P3.4, P4.4				

Outputs	Plan	Source	Make	Deliver	Return
Information Feedback			M1.1		

Process Element: Release Finished Product to Deliver	Process Element Number: M1.6
Process Element Definition	
Activities associated with post-production documentation, testing, or certification required prior to delivery of finished product to customer. Examples include assembly of batch records for regulatory agencies, laboratory tests for potency or purity, creating certificate of analysis, and sign-off by the quality organization.	
Performance Attributes	**Metric**
Reliability	% Release errors
Responsiveness	Release Finished Product To Deliver Cycle Time
Flexibility	None Identified
Cost	Release cost per unit
Assets	None Identified
Best Practices	**Features**
Accurate and low cost batch records for regulatory compliance	Electronic batch records
Review batch records by exception	Electronic batch records linked to process plans/recipes and exceptions flagged
Automated notification of laboratory regarding sample availability	Interface between production system and LIMS

Inputs	Plan	Source	Make	Deliver	Return

Outputs	Plan	Source	Make	Deliver	Return
Information Feedback			M1.1		
Finished Product Release				D1.8, D4.2	

M2: Make-to-Order

- (P3.4) Production Plan
- (S1.1, S2.1, S3.3) Scheduled Receipts
- (M2.2, M2.3, M2.4, M2.5, M2.6) Information Feedback
- (EM.5) Equipment and Facilities Schedules and Plans

M2.1

Schedule Production Activities

- Production Schedule (P3.2, S1.1, S2.1, S3.3, D2.3, D2.8)

- (S1.4, S2.4, S3.6) Inventory Availability
- (EM.4) WIP Handling Rules, Move Information and Methods
- (EM.6) WIP Location Rules

M2.2

Issue Product

- Inventory Availability (P3.2)
- Replenishment Signal (S1.1, S2.1, S3.3),
- Information Feedback (M2.1)
- Product Location Information (EM.6)

M2.3

Produce and Test

- Information Feedback (M2.1)

M2.4

Package

- Information Feedback (M2.1)

- (P3.4) Production Plan
- (P4.4) Deliver Plan

M2.5

Stage Product

- Information Feedback (M2.1)

M2.6

Release Product to Deliver

- Information Feedback (M2.1)
- Product Release (D2.8)

Process Category: Make-to-Order	Process Number: M2
Process Category Definition	
The process of manufacturing in a make to order environment adds value to products through mixing, separating, forming, machining, and chemical processes. A make to order environment is one in which products are completed after receipt of a customer order and are built or configured only in response to a customer order.	
Performance Attributes	**Metric**
Reliability	Perfect Order Fulfillment
Responsiveness	Make Cycle Time
Flexibility	Upside Make Flexibility Downside Make Adaptability Upside Make Adaptability
Cost	Average plant-wide salary Plant Operating Cost per hour Indirect to direct headcount ratio Indirect to direct process cost Unit cost Product Losses (Sourced/In-Process/Finished)
Assets	Cash-to-Cash Cycle Time Inventory Aging Return on Supply Chain Fixed Assets
Best Practices	**Features**
Organization to enhance flexibility: Few job classifications, self-directed work force, flat management structure, and cross-functional work teams.	Support for modular skills inventory with links to training databases, compensation systems, and operator instructions.
Delivery schedules are collaboratively developed with customers	Web-based access to plant scheduling status, collaborative data-sharing environment.
Posted performance results	Data warehouse, report writing, real time data base, and EIS systems
Accurate and approved work instructions/ process plans	Electronic document management
Accurate and low cost batch/configuration records for warranty and regulatory tracking	Electronic batch/configuration records
Paperless order tracking and customer visibility of orders.	Electronic dispatch and data collection with external interface to internet.
Produce products to unique customer requirements	Order entry specifications linked to manufacturing order
Cellular and demand pull manufacturing	Support for cellular and demand pull manufacturing execution
Production level loading	Capacity planning
Link individual performance to organizational and divisional goals	None Identified
Provide continuous formal training to employees	None Identified
Implement employee involvement programs	None Identified
Build subassemblies/products to forecast at highest generic level to minimize make cycle time	None Identified

Process Element: Schedule Production Activities	Process Element: M2.1
Process Element Definition	
Given plans for the production of specific parts, products, or formulations in specific quantities and planned availability of required sourced products, the scheduling of the operations to be preformed in accordance with these plans. Scheduling includes sequencing, and, depending on the factory layout, any standards for setup and run. In general intermediate production activities are coordinated prior to the scheduling of the operations to be preformed in producing a finished product.	
Performance Attributes	**Metric**
Reliability	Percent of orders scheduled to customer request date Schedule achievement
Responsiveness	Schedule Production Activities Cycle Time
Flexibility	None Identified
Cost	WIP inventory days of supply Scheduling resource costs as % of Make costs Plant level order management costs
Assets	Capacity utilization
Best Practices	**Features**
Produce products to unique customer specification	Order entry, engineering, and product specifications linked to production order
Schedule reflects current plant status (equipment availability, other jobs and resource availability) on line	Schedule undated by on line reporting and status systems and re-sequence activities
Schedule optimizes use of shared resources such as tooling and production equipment	Scheduling utilizing optimization techniques Required production resources included in routing/process instructions
Demand-pull manufacturing, including active reduction of manufacturing system time and WIP through the use of demand-pull mechanisms and visual controls	Support for demand-pull mechanisms (Kanban, replenishment signals, ETC.) based on rate schedules and user defined minimum and maximum trigger points.
Schedule minimizes product changeover costs	Advanced scheduling systems that optimize production schedules to minimize setup/cleaning and optimize job sequences
Schedule includes preventative maintenance program	Interface between maintenance system and scheduling system
Maintain data integrity and system accuracy by ensuring 99%+ production data, inventory levels, and schedule requirements	Detail production scheduling model that synchronizes Plan and Make activities
Cross Training/certification	HR/certification support
Demand pull mechanisms	Repetitive scheduling and sequencing
Additional capacity for overflow demand	Outsource manufacturing and work force augmentation providers connected to production schedules via the internet.
Drum-Buffer-Rope Scheduling Technique	See Glossary

Inputs	Plan	Source	Make	Deliver	Return
Production Plan	P3.4				
Scheduled Receipts – depend upon the type of sourced product required. The item sourced could be from a vendor's make-to-stock process, make-to-order, or engineer-to-order process.		S1.1, S2.1, S3.3			
Information Feedback			M2.2, M2.3, M2.4, M2.5, M2.6		
Equipment and Facilities Schedules and Plans			EM.5		

Outputs	Plan	Source	Make	Deliver	Return
Production Schedule	P3.2	S1.1, S2.1, S3.3		D2.3, D2.8	

Process Element: Issue Sourced/In-Process Product	Process Element Number: M2.2
Process Element Definition	
The selection and physical movement of sourced/in-process products (e.g., raw materials, fabricated components, subassemblies, required ingredients or intermediate formulations) from a stocking location (e.g., stockroom, a location on the production floor, a supplier) to a specific point of use location. Issuing product includes the corresponding system transaction. The Bill of Materials/routing information or recipe/production instructions will determine the products to be issued to support the production operation(s).	
Performance Attributes	**Metric**
Reliability	Inventory accuracy % Parts received at point of use
Responsiveness	Issue Sourced/In-Process Product Cycle Time
Flexibility	None Identified
Cost	Inventory obsolescence Inventory days of Supply
Assets	None Identified
Best Practices	**Features**
Demand-pull mechanisms; Kanban replenishment signals from stockroom, intermediate products, or subassembly area	None Identified
Strategic safety stock of selected materials, items, or subassemblies to decouple sourced product issuance cycle time from supplier lead time	None Identified
Electronic material move transactions	Automated process control and/or barcode data collection
Complete lot history	Inventory by lot of sourced/in-process or discrete order /usage reporting by lot or discrete order
Back flush material at order completion	Flexible back flush logic
Supplier delivery to production process at point of use	EDI link to supplier's sales order and inventory systems

Inputs	Plan	Source	Make	Deliver	Return
Inventory Availability		S1.4, S2.4, S3.6			
WIP Handling Rules, Move Information and Methods			EM.4		
WIP Location Rules			EM.6		

Outputs	Plan	Source	Make	Deliver	Return
Inventory Availability	P3.2				
Replenishment Signal		S1.1, S2.1, S3.3			
Information Feedback			M2.1		
Sourced Product Location Information			EM.6		

Process Element: Produce and Test	Process Element Number: M2.3
Process Element Definition	
The series of activities performed upon sourced/in-process product to convert it from the raw or semi-finished state to a state of completion and greater value. The processes associated with the validation of product performance to ensure conformance to defined specifications and requirements.	
Performance Attributes	**Metric**
Reliability	Ratio Of Actual To Theoretical Cycle Time Scrap expense In-process failure rates Yields
Responsiveness	Produce and Test Cycle Time
Flexibility	None Identified
Cost	Warranty costs as % of (S+M+D) costs Total Production Employment Produce and Test costs / unit
Assets	Capacity utilization Asset Turns
Best Practices	**Features**
Just-in-Time/demand flow techniques	Real time data collection
Design/upgrade production equipment to maximize flexibility and avoid line stoppages	Machine productivity and downtime monitoring
Real time quality control techniques	Electronic collection of quality data and on-line SPC
Up-to-date shop packet/specifications	Electronic work instructions
Authorize each operation to assess the quality of the previous operations	None Identified
Paperless production control	Electronic dispatch of operations
Accurate and approved process plans/specifications	Electronic document management
Reduce chances of operator error	Automatic download of production equipment with batch recipes/part programs
Reduce non-value added paperwork while still measuring process metrics	Electronic data collection of completion, quality, scrap, labor and equipment data
Reduce non-value added activities, including queue, move, and set-up times	None Identified
Accurate and low cost batch/configuration records for warranty and regulatory tracking	Electronic batch recording/configuration
Maintain accurate lot/batch history information	Electronic data collection of employee actions and sourced/in-process product lot used

Inputs	Plan	Source	Make	Deliver	Return

Outputs	Plan	Source	Make	Deliver	Return
Information Feedback			M2.1		

Process Element: Package	Process Element Number: M2.4
Process Element Definition	
The series of activities that containerize completed products for storage or sale to end-users. Within certain industries, packaging may include cleaning or sterilization.	
Performance Attributes	**Metric**
Reliability	Warranty costs Yield
Responsiveness	Package Cycle Time
Flexibility	None Identified
Cost	Packaging cost as % of Make cost Scrap Packaging expense
Assets	Asset turns Capacity Utilization
Best Practices	**Features**
Postponement and pre-kitting of accessories into modular packages that allow flexibility while maintaining control	None Identified
Design/upgrade production equipment to maximize flexibility and avoid line stoppages	Machine productivity and downtime monitoring
Accurate and approved process plans, routings, specifications and procedures	Electronic document management
Up-to-date shop packet/specification for each unique production event/demand	Electronic Work Instructions
Paperless production control	Electronic dispatch of operations
Minimize operator induced errors	Automatic download of production equipment with setup parameters Graphical display of setup, changeover, or layout
Reduce non-value added paperwork while still measuring process metrics	Electronic data collection of completion, quality, scrap, and labor data
Packaging operation is an integral part of the overall production process	None Identified
Accurate and low cost batch/configuration records for warranty and regulatory tracking	Electronic batch/configuration records
Automatic label and seal verification	Automatic interface to inspection systems

Inputs	Plan	Source	Make	Deliver	Return

Outputs	Plan	Source	Make	Deliver	Return
Information Feedback			M2.1		

Process Element: Stage Finished Product	Process Element Number: M2.5
Process Element Definition	
The movement of packaged products into a temporary holding location to await movement to a finished goods location. Products that are made to order may remain in the holding location to await shipment per the associated customer order. The actual move transaction is part of the Deliver process.	
Performance Attributes	**Metric**
Reliability	Staging time
Responsiveness	Stage Finished Product Cycle Time
Flexibility	None Identified
Cost	Inventory carrying cost
Assets	WIP Days of Supply
Best Practices	**Features**
Direct ship from factory to customer/channel	Share production status with customers and transportation providers via web-based tools. Auto-Tendering for direct ship utilizing EDI/XML protocols.
Electronic material move transactions	Bar code data collection

Inputs	Plan	Source	Make	Deliver	Return
Production Plan, Delivery Plan as they influence where you stage product due to size of production runs or timing of expected release to Delivery.	P3.4, P4.4				

Outputs	Plan	Source	Make	Deliver	Return
Information Feedback			M2.1		

Process Element: Release Finished Product to Deliver	Process Element Number: M2.6
Process Element Definition	
Activities associated with post-production documentation, testing, or certification required prior to delivery of finished product to customer. Examples include assembly of batch records for regulatory agencies, laboratory tests for potency or purity, creating certificate of analysis, and sign-off by the quality organization.	
Performance Attributes	**Metric**
Reliability	% Release errors
Responsiveness	Release Finished Product To Deliver Cycle Time
Flexibility	None Identified
Cost	Release cost per unit
Assets	None Identified
Best Practices	**Features**
Accurate and low cost batch records for regulatory compliance	Electronic batch records
Review batch records by exception	Electronic batch records linked to process plans/recipes and exceptions flagged
Automated notification of laboratory regarding sample availability	Interface between production system and LIMS

Inputs	Plan	Source	Make	Deliver	Return

Outputs	Plan	Source	Make	Deliver	Return
Information Feedback			M2.1		
Finished Product Release				D2.8	

M3: Engineer-to-Order

- Engineering Design
- (D3.3) Order Information

M3.1

Finalize Engineering

- Methods, Procedures, Processes (M3.2)

- (P3.4) Production Plan
- (M3.3, M3.4, M3.5, M3.6, M3.7) Information Feedback
- (S1.1, S2.1, S3.3) Scheduled Receipts
- (EM.5) Equipment and Facilities Schedules and Plans

M3.2

Schedule Production Activities

- Production Schedule (P3.2, S1.1, S2.1, S3.3, D3.3, D3.7)

- (S1.4, S2.4, S3.6) Inventory Availability
- (EM.4) WIP Handling Rules, Move Information and Methods
- (EM.6) WIP Location Rules

M3.3

Issue Product

- Information Feedback (M3.2)
- Replenishment Signals (S1.1, S2.1, S3.3)
- Sourced Product Location Information (EM.6)

M3.4

Produce and Test

- Information Feedback (M3.2)

M3.5

Package

- Information Feedback (M3.2)

- (P3.4) Production Plan
- (P4.4) Deliver Plan

M3.6

Stage Product

- Information Feedback (M3.2)

M3.7

Release Product to Deliver

- Information Feedback (M3.2)
- Product Release (D3.7)

Process Category: Engineer-to-Order	Process Number: M3
Process Category Definition	
The process of manufacturing distinct items, such as parts that retain their identity through the transformation process and are intended to be completed after receipt of a customer order. While Make to Order includes standard products built only in response to a customer order or products configured in response to a customer order, Engineer to Order includes custom products that are designed, developed, and manufactured in response to a specific customer request.	
Performance Attributes	**Metric**
Reliability	Perfect Order Fulfillment
Responsiveness	Make Cycle Time
Flexibility	Upside Make Flexibility Downside Make Adaptability Upside Make Adaptability
Cost	ECO cost Unit cost Indirect to direct process cost ratio Product Losses (Sourced/In-Process/Finished)
Assets	Cash to Cash Cycle Time Inventory Aging Return on Supply Chain Assets
Best Practices	**Features**
Cellular manufacturing	None Identified
Organize to enhance flexibility: few job classifications, self-directed work force, flat management structure, cross-functional work teams	Support for modular skills inventory with links to training databases, compensations systems, and operator instructions
Delivery schedules are collaboratively developed with customers.	Web-based access to plant scheduling status, collaborative data-sharing environment.
Posted performance results	None Identified
Paperless order tracking and customer visibility of orders.	Electronic dispatch and data collection with external interface to internet.
Demand-pull manufacturing, including active reduction of manufacturing systems time and WIP through the use of demand-pull mechanisms and visual controls	Support of demand-pull mechanisms (Kanban, replenishment signals, etc.) based on rate schedules and user-defined minimum/maximum trigger points
Product design collaboration with customers	On-line design tools facilitated by internet connections.

Process Element: Finalize Production Engineering	Process Element Number: M3.1
Process Element Definition	
Engineering activities required after acceptance of order, but before product can be produced. May include generation and delivery of final drawings, specifications, formulas, part programs, etc. In general, the last step in the completion of any preliminary engineering work done as part of the quotation process.	
Performance Attributes	**Metric**
Reliability	Deliver to commit date variance Number of ECOs
Responsiveness	Finalize Production Engineering Cycle Time
Flexibility	None Identified
Cost	ECO cost as % of Make cost
Assets	Capacity Utilization
Best Practices	**Features**
Automated Configuration Management	Configuration
Automated conversion of engineering drawings into product specifications	None Identified

Inputs	Plan	Source	Make	Deliver	Return
Engineering Design					
Order Information				D3.3	

Outputs	Plan	Source	Make	Deliver	Return
Methods, Procedures, Processes			M3.2		

Process Element: Schedule Production Activities	Process Element Number: M3.2
Process Element Definition	
Given plans for the production of specific parts, products, or formulations in specified quantities and planned availability of required sourced products, the scheduling of the operations to be performed in accordance with these plans. Scheduling includes sequencing, and, depending on the factory layout, any standards for setup and run. In general, intermediate production activities are coordinated prior to the scheduling of the operations to be performed in producing a finished product.	
Performance Attributes	**Metric**
Reliability	% Orders scheduled to customer request date Schedule achievement
Responsiveness	Schedule Production Activities Cycle Time
Flexibility	None Identified
Cost	Inventory days of supply Scheduling resource costs as % of Make costs Plant-level order management costs
Assets	Capacity utilization
Best Practices	**Features**
Build subassemblies to forecast at highest generic level in Bill of Material; maintain flexibility while minimizing cycle time and inventory position	None Identified
Demand-pull mechanisms	Repetitive scheduling or sequencing of unique orders
Schedule reflects current plant status (equipment, jobs, and other resources on-line)	On-line reporting from operations
Schedule optimizes use of shared resources, such as tooling	Resource needs included in routing or Bill of Material
Cellular manufacturing	None Identified
Schedule minimizes changeover costs between products	Algorithms that manage set up times/costs, cleaning times, and ideal job sequences (e.g., color sequencing light to dark)
Schedule includes preventive maintenance program	Interface to maintenance management system
Maximize data integrity and system accuracy by ensuring 99%+ accuracy of BOM configuration, inventory levels, and schedule requirements	None Identified
Design/upgrade production equipment to maximize flexibility and avoid line stoppages	None Identified
Cross-training	None Identified
Additional capacity for overflow demand	Outsource manufacturing and work force augmentation providers connected to production schedules via the internet.
Drum-Buffer-Rope Scheduling Technique	See Glossary

Inputs	Plan	Source	Make	Deliver	Return
Production Plan	P3.4				
Information Feedback			M3.3, M3.4, M3.5, M3.6, M3.7		
Scheduled Receipts – depend upon the type of sourced product required. The item sourced could be from a vendor's make-to-stock process, make-to-order, or engineer-to-order process.		S1.1, S2.1, S3.3			
Equipment and Facilities Schedules and Plans			EM.5		

Outputs	Plan	Source	Make	Deliver	Return
Production Schedule	P3.2	S1.1, S2.1, S3.3		D3.3, D3.7	

Process Element: Issue Sourced/In-Process Product	Process Element Number: M3.3
Process Element Definition	
The selection and physical movement of sourced/in-process products (e.g., raw materials, fabricated components, subassemblies, required ingredients or intermediate formulations) from a stocking location (e.g., stockroom, a location on the production floor, a supplier) to a specific point of use location. Issuing material includes the corresponding system transaction. The Bill of Materials/routing information or recipe/production instructions will determine the materials to be issued to support the production operation(s).	
Performance Attributes	**Metric**
Reliability	Inventory accuracy
Responsiveness	Issue Sourced/In-Process Product Cycle Time
Flexibility	None Identified
Cost	Inventory obsolescence
Assets	None Identified
Best Practices	**Features**
Demand-pull mechanisms; Kanban replenishment signals from stockroom or subassembly area	None Identified
Supplier delivery to production line at point-of-use	EDI link to supplier's sales order and inventory systems
Two-bin floor stock located at work center for "B" and "C" components. Controlled by operators and replenished when one bin is empty	None Identified
Strategic safety stock of selected materials, items or subassemblies to decouple sourced product issuance cycle time from supplier lead time'	None Identified
Electronic material move transactions	Bar code data collection
Back flush material at order completion	Flexible back flush logic

Inputs	Plan	Source	Make	Deliver	Return
Inventory Availability		S1.4, S2.4, S3.6			
WIP Handling Rules, Move Information and Methods			EM.4		
WIP Location Rules			EM.6		

Outputs	Plan	Source	Make	Deliver	Return
Information Feedback			M3.2		
Replenishment Signal		S1.1, S2.1, S3.3			
Sourced Product Location Information			EM.6		

Process Element: Produce and Test	Process Element Number: M3.4
Process Element Definition	
The series of activities performed upon sourced/in-process product to convert it from the raw or semi-finished state to a state of completion and greater value. The processes associated with the validation of product performance to ensure conformance to defined specifications and requirements.	
Performance Attributes	**Metric**
Reliability	Scrap expense In-process failure rates Yields Yield variability
Responsiveness	Produce and Test Cycle Time
Flexibility	None Identified
Cost	Warranty costs as % of (S+M+D) costs Produce and Test costs / unit Total Production Employment Value Added Productivity
Assets	Asset turns
Best Practices	**Features**
Just-in-time demand flow techniques	Streamlined data collection
Design/upgrade production equipment to maximize flexibility and avoid line stoppages	Machine productivity and downtime monitoring
Authorize each operation to assess the quality of the previous operations and prevent operator-introduced errors	Automatic download of production equipment with part programs
Paperless production control	Electronic dispatch of operations
Real time statistical control techniques	Electronic collection of defect data and on-line SPC
Up-to-date shop packet/specifications	Electronic work instructions
Reduce non-value added paperwork while still measuring process metrics	Electronic data collection of completion, quality, scrap, and labor data
Reduce non-value added activities, including queue, move, and set-up times	None Identified
Link individual performance to organizational and divisional goals	None Identified
Provide continuous formal training to employees	None Identified
Implement employee involvement program	None Identified
Maintain accurate lot/batch history information	Electronic data collection of employee actions and sourced/in-process lot or subassemblies used

Inputs	Plan	Source	Make	Deliver	Return

Outputs	Plan	Source	Make	Deliver	Return
Information Feedback			M3.2		

Process Element: Package	Process Element Number: M3.5
Process Element Definition	
The series of activities that containerize completed products for storage or sale to end-users. Within certain industries, packaging may include cleaning or sterilization.	
Performance Attributes	**Metric**
Reliability	Warranty costs
Responsiveness	Package Cycle Time
Flexibility	None Identified
Cost	Packaging Costs as % of Make cost Scrap Packaging Expense
Assets	Asset turns Capacity utilization
Best Practices	**Features**
Postponement and pre-kitting of accessories into modular packages that allow flexibility while maintaining control	None Identified
Design/upgrade production equipment to maximize flexibility and avoid line stoppages	Machine productivity and downtime monitoring
Up to date shop packet/specifications	Electronic work instructions
Paperless production control	Electronic dispatch of operations
Minimize operator-induced errors	Automatic download of production equipment with setup parameters
Reduce non-value added paperwork while still measuring process metrics	Electronic data collection of completion, quality, lot tractability, scrap, and labor data
Packaging operation is an integral part of the overall production process	None Identified
Automatic label and seal verification	Automatic interface to inspection systems

Inputs	Plan	Source	Make	Deliver	Return

Outputs	Plan	Source	Make	Deliver	Return
Information Feedback			M3.2		

Process Element: Stage Finished Product	Process Element Number: M3.6
Process Element Definition	
The movement of packaged products into a temporary holding location to await movement to a finished goods location. Products that are made to order may remain in the holding location to await shipment per the associated customer order. The actual move transaction is part of the Deliver process.	
Performance Attributes	**Metric**
Reliability	Staging Time
Responsiveness	Stage Finished Product Cycle Time
Flexibility	None Identified
Cost	Inventory Carrying Cost
Assets	None Identified
Best Practices	**Features**
Direct ship from factory to customer/channel	Share production status with customers and transportation providers via web-based tools. Auto-Tendering for direct ship utilizing EDI/XML protocols
Electronic product move transactions	Bar code data collection

Inputs	Plan	Source	Make	Deliver	Return
Production Plan, Deliver Plan as they influence where you stage product due to size of production runs or timing of expected release to Delivery.	P3.4, P4.4				

Outputs	Plan	Source	Make	Deliver	Return
Information Feedback			M3.2		

Process Element: Release Product to Deliver	Process Element Number: M3.7
Process Element Definition	
Activities associated with post-production documentation, testing, or certification required prior to delivery of finished product to customer. Examples include assembly of batch records for regulatory agencies, laboratory tests for potency or purity, creating certificate of analysis, and sign-off by the quality organization.	
Performance Attributes	**Metric**
Reliability	% Release errors
Responsiveness	Release Product To Deliver Cycle Time
Flexibility	None Identified
Cost	Release cost per unit
Assets	None Identified
Best Practices	**Features**
Accurate and low cost batch records for regulatory compliance	Electronic batch records
Review batch records by exception	Electronic batch records linked to process plans/recipes and exceptions flagged
Automated notification of laboratory regarding sample availability	Interface between production system and LIMS

Inputs	Plan	Source	Make	Deliver	Return

Outputs	Plan	Source	Make	Deliver	Return
Information Feedback			M3.2		
Finished Product Release				D3.7	

EM: Enable Make

- Business Plans
- Corporate Objectives and Strategies
- Product Design
- (P) Functional Strategies, Production Plans, Production Capability

↓

EM.1

Manage Production Rules

↓

- Production Rules (P, S, M, D)

- Business Plans
- Corporate Objectives and Strategies
- Product Design/Quality
- (P) Functional Strategies, Production Plans, Production Capability

↓

EM.2

Manage Production Performance

↓

- Production Rules (P, S, M, D)
- Production Quality and Policies (EM.5)

- Information Needed to Create and Maintain IT
- (P, S, M, D) Information Needs Analysis
- (S, M) Systems Capability
- (P, S, M, D) Information from Business Processes

↓

EM.3

Manage MAKE Information

↓

- Information Infrastructure Plan (P, S)
- Reports, Information, and Documents (P, S, M, D)

- (P) Capacity Requirements, Production Orders Planned
- (S) Incoming Product Information
- (D) Returned Product Information

↓

EM.4

Manage In-Process Products (WIP)

↓

- WIP Handling Rules, Move Information and Methods (P, S, M1.2, M2.2, M3.3, EM.6, D)

- (P) Production Plans and Budgets
- (S) MRO Parts Availability
- (EM.2) Production Quality and Policies
- Equipment and Facilities Monitoring Information
- Manufacturer's Recommended Maintenance Schedules & Specifications

↓

EM.5

Manage Equipment and Facilities

↓

- Preventative Maintenance and Calibration Schedule (P, S, M1.1, M2.1, M3.2)
- Equipment and Facilities Schedules and Plans (M1.1, M2.1, M3.2)
- Equipment and Facilities Replacement and Disposition Plans (P, EM.6)
- Parts and Services Consumed (S)
- Equipment and Facilities Maintenance History (S, M)
- Production Status (EM.7)

EM: Enable Make

- Production Orders Planned and Actual Reports
- (P) Capacity Requirements
- (S) Supplier Agreement
- (M1.2, M2.2, M3.3, D) Product Location Information
- (P, S, M, EM.4, D) WIP Handling Rules
- (EM.5) Equipment and Facilities Replacement and Disposition Plans
- (EM.7) Projected Delivery Requirements

EM.6

Manage Transportation

- WIP Location Rules (M1.2, M2.2, M3.3, D2.8)
- WIP Move Information and Methods (P, S, M, D)

- (P) Supply Chain Plans, Planning Data
- (EM.5) Production Status

EM.7

Manage Production Network

- Internal Capacity (P, S)
- Cost to Produce (P)
- Projected Delivery Requirements (P, EM.6, D)

- (P, S, M) External Regulatory Information
- Corporate Objectives and Strategies
- Product Design/Claims
- Equipment and Facility Characteristics

EM.8

Manage Production Regulatory Compliance

- Conformance Rules (M)
- Conformance Plan (S, M)

Enable Process: Manage Production Rules	Process Number: EM.1
Enable Process Definition	
The process of establishing, maintaining, and enforcing rules for managing production details in line with business strategy, goals, and objectives. Production details include part/item master, bills of materials/formulas, routings, processes, equipment requirements, tooling, and other information specifying the method of production for a particular product.	
Performance Attributes	**Metric**
Reliability	None Identified
Responsiveness	None Identified
Flexibility	None Identified
Cost	Plant Level Order Management Costs Total Internal and/or External Costs That Are The Result of Inaccurate Production Rule Details
Assets	% Utilization of Production Rules Preparation
Best Practices	**Features**
Attribute-Based Process Planning	Computer aided process planning / recipe management
On Line Access And Notification Of Tooling And Equipment Information	Delivery of tooling and equipment details drawings
Automated Engineering Specifications	Automated Intelligence (Heuristic) - based engineering specifications system
Automated Links To Existing CAD & CAM Information	Electronic hypertext or links to existing database of detail/parts/setup sketches/drawings
Automatic Generation / Configuration Of Tooling / Set-Up Instructions	Parametric driven (Group Technology - based) manufacturing design system
Pre-Defined Manufacturing Design Rules	Libraries of manufacturing capabilities or design envelopes
Automatic Link To Recipe Management, PLC Program, CNC Program Systems, Etc., To Deliver New Manufacturing Documentation	Seamless application interface to manufacturing planning documentation and CAM systems
Automatic Notification When To Begin And When To Complete	Workflow/Groupware
Storage And Configuration Management For Release And Revision Control Of Final Documents	Product data management (PDM) or Electronic Data Management (EDM) feature set
Electronic Documentation And Imaging	Graphical display of drawings, diagrams, recipes/formulas, specifications, instructions, etc., to all users
Document Control	Control who can create, revise and access information
Genealogy Tracking	Where-used listing of as-planned vs. as-built documentation
Design For Production	Table of manufacturing capacities or design envelops (capacities; envelop sizes; tank, vessel or batch sizes)

Inputs	Plan	Source	Make	Deliver	Return
Corporate Objectives and Strategies					
Functional strategies	EP.4, .5, .6.				
Business Plans					
Production Plans	P3.4, P				
Product Design					
Production Capability	EP, PM				

Outputs	Plan	Source	Make	Deliver	Return
Production Rules	P	S	M	D	

Enable Process: Manage Production Performance	Process Number: EM.2
Enable Process Definition	
The process of developing and maintaining performance standards and analysis methods to compare actual production performance against the established standards. This process allows the development and implementation of a course of action to achieve targeted performance.	
Performance Attributes	**Metric**
Reliability	Percent standards completed on time Percentage of "right first-time" corrective actions
Responsiveness	None Identified
Flexibility	None Identified
Cost	Costs Associated with Managing Production Performance as a % Make Cost.
Assets	None Identified
Best Practices	**Features**
Standards and measurements aligned to maximize supply chain performance	Internal/external benchmarking, industry standards, customer/supplier alignment agreements, visibility of key performance indicators
Real Time Performance Measurement Reporting Systems	Systems to collect production information online generate reports upon request by operators, and track progress against schedule and standards.
Periodic Revi ew of Standards	Process for establishing and maintaining review schedules

Inputs	Plan	Source	Make	Deliver	Return
Business Plans					
Corporate Objectives and Strategies					
Product Design/Quality					
Functional Strategies, Production Plans, Production Capability	P				

Outputs	Plan	Source	Make	Deliver	Return
Production Rules	P	S	M	D	
Production Quality and Policies			EM.5		

Enable Process: Manage MAKE Information	**Process Number: EM.3**
Enable Process Definition	
The process of managing, collecting, maintaining, and communicating information to support MAKE planning and execution processes. The information to be managed includes production, order and process data.	
Performance Attributes	**Metric**
Reliability	% Of time data is available when needed % Of data accuracy Production Process Validation Frequency Decision Timeframe Ratio
Responsiveness	None Identified
Flexibility	None Identified
Cost	Cost of Managing Make as % of Make cost
Assets	% Of information management assets used / production assets
Best Practices	**Features**
On-demand access of Production Information	Data Collection and Display Systems designed for efficient performance of value-added operations in production. This could include using PLC, Machine Interface, bar code, Radio Frequency Communication, Radio Frequency Identification, Magnetic Stripe, Smart Cards, etc., to enable data collection
Utilize Enterprise Information Systems	Enter, Process, and Deliver information about the manufacturing process to management using information systems that span the enterprise
Continuous Improvement	Historical trending, cause and effect analysis, and Key Performance Indicators Scheduling reviews of processes for possible improvements
On-demand access to available to promise (ATP), production schedules and inventory status by internal operations and customers.	Electronic management of products and orders with access to data via Web-based tools.
ERP-based Environmental Performance Indicator module (EPI module)	See Glossary

Inputs	**Plan**	**Source**	**Make**	**Deliver**	**Return**
Information Needed to Create and Maintain IT					
Information Needs Analysis	P	S	M	D	
Systems Capability		S	M		
Information from Business Processes	P	S	M	D	

Outputs	**Plan**	**Source**	**Make**	**Deliver**	**Return**
Information Infrastructure Plan	P	S			
Reports, Information, and Documents	P	S	M	D	

Enable Process: Manage In-Process Products (WIP)	Process Number: EM.4
Process Element Definition	
The process of establishing and maintaining limits or levels, replenishment models, ownership, product mix and stocking locations for In-Process Product (WIP).	
Performance Attributes	**Metric**
Reliability	WIP Inventory cycle-counting accuracy % Downtime due to non-availability of WIP
Responsiveness	None Identified
Flexibility	None Identified
Cost	Cost Of In-Process Product (WIP) Damaged from Handling/Storage as a Percentage of Total Material Cost Cost of handling of WIP Cost of storage space Administrative costs associated with handling/storage of WIP
Assets	% Equipment utilization for handling/storage of WIP % Space utilization for WIP storage
Best Practices	**Features**
First In – First Out	Part / WIP location by date received for those parts that must be stocked or staged in a holding area
Minimizing In-Process Product (WIP)	WIP Storage Management System Efficient Space Utilization Implementing Pull Systems
Supplier Managed Inventory	The supplier is responsible for maintaining inventory levels at the point of use. The software system verifies usage, receiving, and payment functions.
Minimum Product Handling	Move high frequency used inventory close to point of use. For example, the system should provide the frequency of picks by part number so that high frequency picks can be moved to convenient locations or part pick quantities increased.
In-Process Product (WIP) Handling Rules	Tracking, genealogy
Dunnage Control	System data field to specify where the part / product shipping container should be removed. Best practice is to remove the dunnage as soon as possible unless part / product damage will result. Reuse of intermediate WIP containers for finished goods.
Optimize Packing	No packing and unpacking time required. Recyclable or no containers where appropriate. No discarded material.

Inputs	Plan	Source	Make	Deliver	Return
Capacity Requirements, Production Orders Planned	P				
Incoming Sourced Product Information		S			
Returned Product Information				D	

Outputs	Plan	Source	Make	Deliver	Return
WIP Handling Rules, Move Information and Methods	P	S	M1.2, M2.2, M3.3, EM.6	D	

Enable Process: Manage MAKE Equipment and Facilities	Process Number: EM.5
Process Element Definition	
The process of specifying maintaining and dispositioning MAKE's capital assets to operate the supply chain production processes. This includes repair, alteration, calibration and other miscellaneous items to maintain production capabilities.	
Performance Attributes	**Metric**
Reliability	Unplanned Maintenance Downtime % of total Production Time Percentage Completed PM Work Orders Mean Time Between Failure
Responsiveness	None identified
Flexibility	None Identified
Cost	Equipment/Facility Maintenance Cost as % of Make Cost
Assets	Actual Asset Life Maintenance Cost as % of Replacement Value Make Fixed Asset Costs
Best Practices	**Features**
Total Preventative Maintenance Program	Automatically generated TPM repair schedules integrated with MRP systems, electronic equipment repair history, parts listings, part stores inventory & reorder points, automatic store room parts purchases, Shop floor access to electronic data base of equipment line drawings, electrical wiring diagrams, parts listing reference guide and part cost lists.
Changeover Reduction / Continuous Improvement Program	Changeover process flow element identification, instructional directions to conduct changeover, and measurement tool, which can be used to prioritize and track results of improvement efforts. Software to identify operational constraints to the MAKE processes to assist in directing resources toward bottleneck functional areas.
Factory Floor Electronic Decision Making Information System	Software to capture actual performance history / costs of operations with capability of predicting "best cost action plans" relating to maintaining equipment and facilities.
Facility & Equipment Environmental / Safety Audit System	System software to list checklist items, report results of audit & forward actions to be taken
Supplier Managed Inventory Of Parts	E.D.I. linkage of Inventory Information
Predictive Maintenance Monitoring (Heat, Noise, Lubrication Composition & Vibration)	Database for equipment to contain expected results of analysis, allow entry of test readings, and have capability of generating desired reports, which could highlight suggested actions based upon readings obtained, track maintenance completed, contain a help-file to be consulted
Systematic Disposition Of Equipment	Rules for deciding appropriate disposition.
Minimize capital assets required and maintenance costs.	Outsourcing strategies including the use of Application Service Providers (ASPs), web-based maintenance/diagnostic assistance and MRO parts.
ERP-based Environmental Performance Indicator module (EPI module)	See Glossary

Inputs	Plan	Source	Make	Deliver	Return
Production Plans and Budgets	P		M		
MRO Parts Availability		S			
Production Quality and Policies			EM.2		
Equipment and Facilities Monitoring Information					
Manufacturer's Recommended Maintenance Schedules & Specifications					

Outputs	Plan	Source	Make	Deliver	Return
Preventative Maintenance and Calibration Schedule	P	S	M1.1, M2.1, M3.2		
Equipment and Facilities Schedules and Plans			M1.1, M2.1, M3.2		
Equipment and Facilities Replacement and Disposition Plans	P				
Parts and Services Consumed		S			
Equipment and Facilities Maintenance History		S	M		
Production Status			EM.7		

Enable Process: Manage Transportation (WIP)	Process Number: EM.6
Enable Process Definition	
The process of transporting In-Process Product (WIP). This includes management of the activities associated with in transit handling and movement of In-Process Product (WIP).	
Performance Attributes	**Metric**
Reliability	% Downtime due to non-delivery of WIP
Responsiveness	None Identified
Flexibility	None Identified
Cost	Cost Of In-Process Product (WIP) Damaged from Handling/Storage as a Percentage of Total Material Cost Cost of handling and movement of in transit WIP materials Cost of in transit storage space Administrative Costs Associated with In-Transit Handling/Movement of In-Process Product
Assets	% Equipment utilization for in transit handling and movement of WIP
Best Practices	**Features**
Short Move Paths	Software that allows for input of the distance that particular parts / WIP need to be moved. This software then needs to provide a report based on the cubic feet of material times distance moved by part number
Reduce In-Process Product (WIP) Handling	Reduction of WIP handling through automation (i.e. AGVs and ASRS) and process improvement (i.e. reduction of handling steps, shorter move paths)

Inputs	Plan	Source	Make	Deliver	Return
Production Orders Planned and Actual Reports					
Capacity Requirements	P				
Supplier Agreement		S			
Sourced Product Location Information			M1.2, M2.2, M3.3	D	
WIP Handling Rules	P	S	EM.4	D	
Equipment and Facilities Replacement and Disposition Plans			EM.5		
Projected Delivery Requirements			EM.7		

Outputs	Plan	Source	Make	Deliver	Return
WIP Location Rules			M1.2, M2.2, M3.3	D2.8	
WIP Move Information and Methods	P	S	M	D	

Enable Process: Manage Production Network	Process Number: EM.7
Process Definition	
The process of identifying and maintaining a network of intra-company production units that deliver specific semi-finished materials or product sets to the final production site.	
Performance Attributes	**Metric**
Reliability	% on time, % rejects
Responsiveness	None Identified
Flexibility	None Identified
Cost	None identified
Assets	ROTA (return on total assets)
Best Practices	**Features**
JIT environment	Schedule visibility, on-line communications between source and demand
Collaborative planning/scheduling	Interactive, on-line planning/scheduling systems. Capacity planning systems with accurate production capability data.
Production reporting/status	Real time monitoring of production status and In-Process Product (WIP)

Inputs	Plan	Source	Make	Deliver	Return
Supply Chain Plans, Planning Data	P				
Production Status			EM.5		

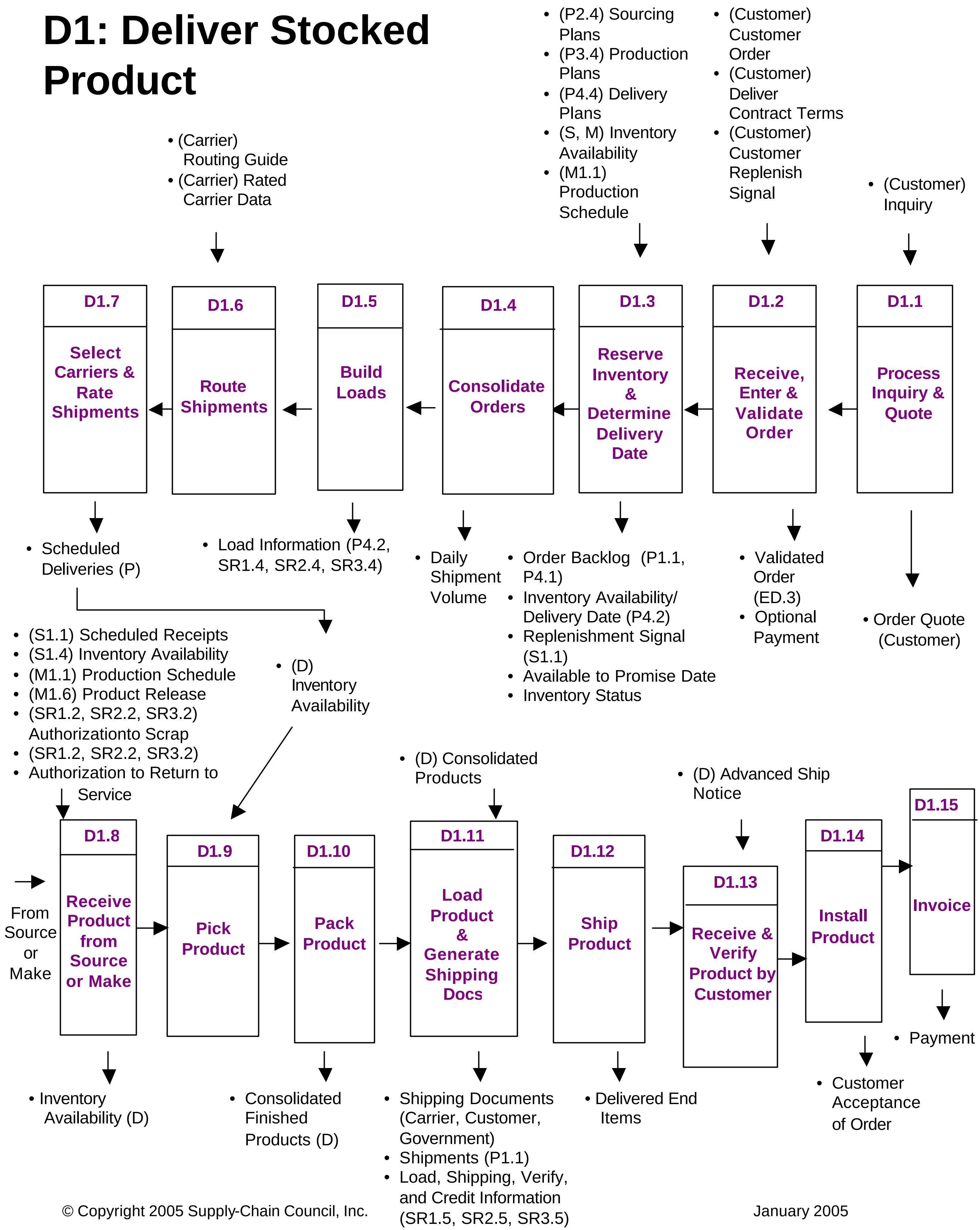
Outputs	Plan	Source	Make	Deliver	Return
Internal Capacity	P	S			
Cost to Produce	P				
Projected Delivery Requirements	P		EM.6	D	

Enable Process: Manage MAKE Regulatory Compliance	Process Number: EM.8
Enable Process Definition	
The process of identifying and complying with regulatory documentation and process standards set by external entities (eg government)	
Performance Attributes	**Metric**
Reliability	% Regulations met by required date Severity of instances of non-conformance per unit time Downtime in MAKE due to compliance issues
Responsiveness	None Identified
Flexibility	None Identified
Cost	Cost of compliance including administrative costs Cost of non-compliance
Assets	% Cost of assets used for compliance/total MAKE asset cost
Best Practices	**Features**
Automatic Generation And Submission Of Conformance Documents	Software specific to industry regulations and standards (e.g. may be software to produce MSDS documents, or FDA requirements, etc.)
Maintaining Repository Of Current Regulatory Requirements	Electronic subscription and publication of conformance documentation. Electronic Document Management System features.
Automated Conformance Monitoring And Control	Internal automatic notification of conformance, including holding of product until requirements are met
ERP-based Environmental Performance Indicator module (EPI module)	See Glossary

Inputs	Plan	Source	Make	Deliver	Return
External Regulatory Information	P	S	M		
Corporate Objectives and Strategies					
Product Design/Claims					
Equipment and Facility Characteristics					

Outputs	Plan	Source	Make	Deliver	Return
Conformance Rules			M		
Conformance Plan		S	M		

D1: Deliver Stocked Product



Process Category: Deliver Stocked Product	Process Number: D1
Process Category Definition	
The process of delivering product that is maintained in a finished goods state prior to the receipt of a firm customer order.	
Performance Attributes	**Metric**
Reliability	Perfect Order Fulfillment
Responsiveness	Order Fulfillment Cycle Time
Flexibility	Upside Deliver Flexibility Downside Deliver Adaptability Upside Deliver Adaptability
Cost	Order Management Costs as % of Deliver costs
Assets	Cash to Cash Cycle Time Return on Supply Chain Fixed Assets
Best Practices	**Features**
Rapid replenishment, VMI, EDI	None Identified
Electronic Catalogues/Malls	None Identified
Internet Ordering	None Identified
Efficient Consumer Response (ECR); Quick Response	Demand Planning, Deployment, Scheduling
Vendor Managed Inventory (VMI)	See Glossary

Process Element: Process Inquiry & Quote	Process Element Number: D1.1
Process Element Definition	
Receive and respond to general customer inquiries and requests for quotes	
Performance Attributes	**Metric**
Reliability	# Of Call backs as % of total inquiries
Responsiveness	None Identified
Flexibility	None Identified
Cost	Cost / type of Inquiry & Quote
Assets	None Identified
Best Practices	**Features**
Quote capability, without reserving inventory, which can be converted into an order in a single step	None Identified
Single point of contact for all order inquires (including order entry)	None Identified

Inputs	Plan	Source	Make	Deliver	Return
(Customer) Inquiry					

Outputs	Plan	Source	Make	Deliver	Return
Order Quote (Customer)					

Process Element: Receive, Enter & Validate Order	Process Element Number: D1.2
Process Element Definition	
Receive orders from the customer and enter them into a company's order processing system. Orders can be received through phone, fax, or electronic media. "Technically" examine orders to ensure an orderable configuration and provide accurate price. Check the customer's credit. Optionally accept payment.	
Performance Attributes	**Metric**
Reliability	None Identified
Responsiveness	Receive, Enter and Validate Order Cycle Time
Flexibility	Upside Deliver Flexibility Downside Deliver Adaptability Upside Deliver Adaptability
Cost	Order cost / type of order Order Entry and Maintenance Costs as % of (S+M+D) cost
Assets	None Identified
Best Practices	**Features**
Electronic Commerce (customer visibility of stock availability, use of hand-held terminals for direct order entry, confirmation, credit approval), On-line stock check and reservation of inventory	EDI applications and integrated order management
Enable real-time visibility into backlog, order status, shipments, scheduled material receipts, customer credit history, and current inventory positions	None Identified
Continuous Replenishment Programs; Vendor Managed Inventory, Telemetry to automatically communicate replenishment of chemicals	Integrated demand/deployment planning to customer location driven by POS; Customer movement data
Remote (sales, customers) order entry capability	None Identified
Automatic Multi-level Credit Checking: Dollar Limits; Days Sales Outstanding; Margin Testing	Integrated Order/Financial Management
Value Pricing based on "Cost to Serve"; EDLP; Cost Plus Pricing	Activity Based Costing; Integrated Order Management by Customer by Line Item

Inputs	Plan	Source	Make	Deliver	Return
(Customer) Customer Order					
(Customer) Deliver Contract Terms					
(Customer) Customer Replenish Signal					

Outputs	Plan	Source	Make	Deliver	Return
Validated Order				ED.3	
Optional Payment					

Process Element: Reserve Inventory & Determine Delivery Date	Process Element Number: D1.3
Process Element Definition	
Inventory and/or planned capacity (both on hand and scheduled) is identified and reserved for specific orders and a delivery date is committed and scheduled.	
Performance Attributes	**Metric**
Reliability	Delivery Performance To Customer Commit Date
Responsiveness	Reserve Inventory and Determine Delivery Date Cycle Time
Flexibility	None Identified
Cost	Finished Goods Inventory Days of Supply
Assets	Finished Goods Inventory Carry Cost
Best Practices	**Features**
EDI links between manufacturing and distributor to achieve visibility of complete finished goods inventory and expected shipments	None Identified
Automatic reservation of inventory and dynamic sourcing of product for single shipment to customer	Integrated order management system that treats each order line as a separate order with integration to inventory source and status; Real-time inventory management
ATP and Product Reservation	Integration with scheduling and inventory management
Priority-based inventory reservations, for key customers, with FIFO allocation for all others	None Identified
Inventory allocation exception process is clearly defined and jointly owned by manufacturing and sales	None Identified

Inputs	Plan	Source	Make	Deliver	Return
Sourcing Plans	P2.4				
Production Plans	P3.4				
Deliver Plans	P4.4				
Inventory Availability		S	M		
Production Schedule			M1.1		

Outputs	Plan	Source	Make	Deliver	Return
Order Backlog	P1.1, P4.1				
Inventory Availability/Delivery Date	P4.2				
Replenishment Signal		S1.1			
Available to Promise Date			M		
Inventory Status	P	S	M	D	

Process Element: Consolidate Orders	Process Element Number: D1.4
Process Element Definition	
The process of analyzing orders to determine the groupings that result in least cost/best service fulfillment and transportation.	
Performance Attributes	**Metric**
Reliability	Order Consolidation Profile
Responsiveness	Consolidate Orders Cycle Time
Flexibility	None Identified
Cost	Transportation Costs
Assets	None Identified
Best Practices	**Features**
Consolidate orders by customer, source, traffic lane, carrier, etc.	Integrated load planning and building with warehouse management
Combine consolidation needs with other products/divisions/companies	None Identified

Inputs	Plan	Source	Make	Deliver	Return

Outputs	Plan	Source	Make	Deliver	Return
Daily Shipment Volume					

Process Element: Build Loads	Process Element Number: D1.5
Process Element Definition	
Transportation modes are selected and efficient loads are built.	
Performance Attributes	**Metric**
Reliability	None Identified
Responsiveness	Build Loads Cycle Time
Flexibility	Upside Deliver Flexibility Downside Deliver Adaptability Upside Deliver Adaptability
Cost	Transportation Costs
Assets	None Identified
Best Practices	**Features**
Consolidation of inbound and outbound requirements	Integrated inbound/outbound transportation planning
Build load in stop sequence (i.e. 1st truck destination loaded last, etc.)	Same as above
CRP & VMI loads optimized for utilization	Integration with CRP/VMI vendor systems
Vendor Managed Inventory (VMI)	See Glossary

Inputs	Plan	Source	Make	Deliver	Return

Outputs	Plan	Source	Make	Deliver	Return
Load Information	P4.2				SR1.4, SR2.4, SR3.4

Process Element: Route Shipments	Process Element Number: D1.6
Process Element Definition	
Loads are consolidated and routed by mode, lane and location.	
Performance Attributes	**Metric**
Reliability	None Identified
Responsiveness	Route Shipments Cycle Time
Flexibility	None Identified
Cost	Transportation Costs
Assets	None Identified
Best Practices	**Features**
CRP/VMI	Integrated Load Building; Routing & Scheduling with Advanced Ship Notice (ASN)
Consolidation of Carriers	Transportation Modeling and Rate Analysis
Carrier/Route Optimization based on continuous movement and consolidation/pooling	Route scheduling, carrier selection, and rating
Shipment tracking and tracing	Satellite communications & GPS
Vendor Managed Inventory (VMI)	See Glossary

Inputs	Plan	Source	Make	Deliver	Return
(Carrier) Routing Guide					
(Carrier) Rated Carrier Data					

Outputs	Plan	Source	Make	Deliver	Return

Process Element: Select Carriers & Rate Shipments	Process Element Number: D1.7
Process Element Definition	
Specific carriers are selected by lowest cost per route and shipments are rated and tendered.	
Performance Attributes	**Metric**
Reliability	None Identified
Responsiveness	Select Carriers and Rate Cycle Time
Flexibility	None Identified
Cost	Transportation Costs
Assets	None Identified
Best Practices	**Features**
Select carriers by least cost per shipment and rate using actual rates prior to release to billing	Rules based carrier selection and actual rate database

Inputs	Plan	Source	Make	Deliver	Return

Outputs	Plan	Source	Make	Deliver	Return
Scheduled Deliveries	P				

Process Element: Receive Product from Source or Make	Process Element Number: D1.8
Process Element Definition	
The activities such as receiving product, verifying, recording product receipt, determining put-away location, putting away and recording location that a company performs at its own warehouses. May include quality inspection.	
Performance Attributes	**Metric**
Reliability	Incoming Material Quality
Responsiveness	Dock To Stock Cycle Time
Flexibility	None Identified
Cost	Receiving costs / type of receipt
Assets	Finished Goods Inventory Days of Supply Inventory Obsolescence as a % of Total Inventory End-of-Life Inventory
Best Practices	**Features**
Automatic Identification	Bar Coding & Radio Frequency Communications
Download P.O. & Advanced Ship Notices for Automated Receiving and Put away	Integration with Procurement Systems & Electronic Commerce with Vendors
Dynamic location assignment including lot control, zoned put away, quality assurance, ABC frequency of access	Real time inventory control, stock locator, and rules based put away logic
Cross-Docking	See Glossary
Merge-in-Transit	See Glossary

Inputs	Plan	Source	Make	Deliver	Return
Scheduled Receipts		S1.1			
Inventory Availability		S1.4			
Production Schedule			M1.1		
Finished Product Release			M1.6		
Authorization to Scrap					SR1.2, SR2.2, SR3.2
Authorization to Return to Service					SR1.2, SR2.2, SR3.2

Outputs	Plan	Source	Make	Deliver	Return
Inventory Availability				D	

Process Element: Pick Product	Process Element Number: D1.9
Process Element Definition	
The series of activities including retrieving orders to pick, determining inventory availability, building the pick wave, picking the product, recording the pick and delivering product to packing area in response to an order.	
Performance Attributes	**Metric**
Reliability	Fill Rates
Responsiveness	Pick Product Cycle Time
Flexibility	None Identified
Cost	Product Picking Cost / type of order
Assets	None Identified
Best Practices	**Features**
Dynamic simulation of picking requirements optimized for labor, cost, and time	Rules based picking logic and simulation
Dynamic location assignment including lot control, zoned picking, quality assurance	Real time inventory control, stock locator, and rules based picking logic
Use of speed racks for automated material handling	None Identified
Merge-in-Transit	See Glossary
Wave picking	See Glossary

Inputs	Plan	Source	Make	Deliver	Return
Scheduled Deliveries	P				
Inventory Availability				D	

Outputs	Plan	Source	Make	Deliver	Return

Process Element: Pack Product	Process Element Number: D1.10
Process Element Definition	
The activities such as sorting / combining the products, packing / kitting the products, paste labels, barcodes etc. and delivering the products to the shipping area for loading.	
Performance Attributes	**Metric**
Reliability	None Identified
Responsiveness	Pack Product Cycle Time
Flexibility	None Identified
Cost	Product Packing Cost / type of order
Assets	None Identified
Best Practices	**Features**
Postponement strategies	Postponement of final configuration to the nearest point to the customer. For example pack country-specific documentation with generic finished product to create country-specific finished good to be shipped.

Inputs	Plan	Source	Make	Deliver

Outputs	Plan	Source	Make	Deliver
Consolidated Finished Products				D

Process Element: Load Vehicle & Generate Shipping Documentation	Process Element Number: D1.11
Process Element Definition	
The series of tasks including placing/loading product onto modes of transportation, and generating the documentation necessary to meet internal, customer, carrier and government needs. Shipping documentation includes the invoice. Optionally verify customer credit.	
Performance Attributes	**Metric**
Reliability	Delivery Performance to Customer Commit Date
Responsiveness	Load Vehicle and Generate Shipping Documentation Cycle Time
Flexibility	None Identified
Cost	Loading costs / type of load
Assets	None Identified
Best Practices	**Features**
Advanced Shipping Notices & UCC128 container labeling	Bar coding; EDI; integrated transportation/warehouse management
Integrated Credit Checking	Interface to supplier's shipping system to financials
Shipment Tracking	None Identified
Electronic generation and download of shipping documents	None Identified
Full visibility of credit history by shipping personnel	None Identified
Supplier (Carrier) Agreements	See Glossary
Cross Docking	See Glossary

Inputs	Plan	Source	Make	Deliver	Return
Consolidated Products				D	

Outputs	Plan	Source	Make	Deliver	Return
Shipping Documents (Carrier, Customer, Government)					
Shipments	P1.1				
Load, Shipping, Verify, and Credit Information					SR1.5, SR2.5, SR3.5

Process Element: Ship Product	Process Element Number: D1.12
Process Element Definition	
The process of shipping the product to the customer site.	
Performance Attributes	**Metric**
Reliability	None Identified
Responsiveness	Ship Product Cycle Time
Flexibility	None Identified
Cost	None Identified
Assets	None Identified
Best Practices	**Features**
Shipment Tracking	None Identified
Cross Docking	See Glossary

Inputs	Plan	Source	Make	Deliver	Return

Outputs	Plan	Source	Make	Deliver	Return
Delivered End Items (Customer)				D	

Process Element: Receive & Verify Product by Customer	Process Element Number: D1.13
Process Element Definition	
The process of receiving the shipment by the customer (either at customer site or at shipping area in case of self-collection) and verifying that the order was shipped complete and that the product meets delivery terms.	
Performance Attributes	**Metric**
Reliability	None Identified
Responsiveness	Receive and Verify Product Cycle Time
Flexibility	None Identified
Cost	Receive & Verify cost / type of receipt Cost of non-conformance
Assets	None Identified
Best Practices	**Features**
None Identified	None Identified

Inputs	Plan	Source	Make	Deliver	Return
Advanced Ship Notice				D	

Outputs	Plan	Source	Make	Deliver	Return

Process Element: Install Product	Process Element Number: D1.14
Process Element Definition	
When necessary, the process of preparing, testing and installing the product at the customer site. The product is fully functional upon completion.	
Performance Attributes	**Metric**
Reliability	% Faultless Installations
Responsiveness	Install Product Cycle Time
Flexibility	None Identified
Cost	Product Install cost / type of installation
Assets	None Identified
Best Practices	**Features**
Joint Service Agreements to document acceptable service levels in terms of installation costs, installation cycle time, etc. This would be effective between customer and supplier, and between internal functions such as Field Service, Manufacturing, Marketing and Order Management	None Identified

Inputs	Plan	Source	Make	Deliver	Return

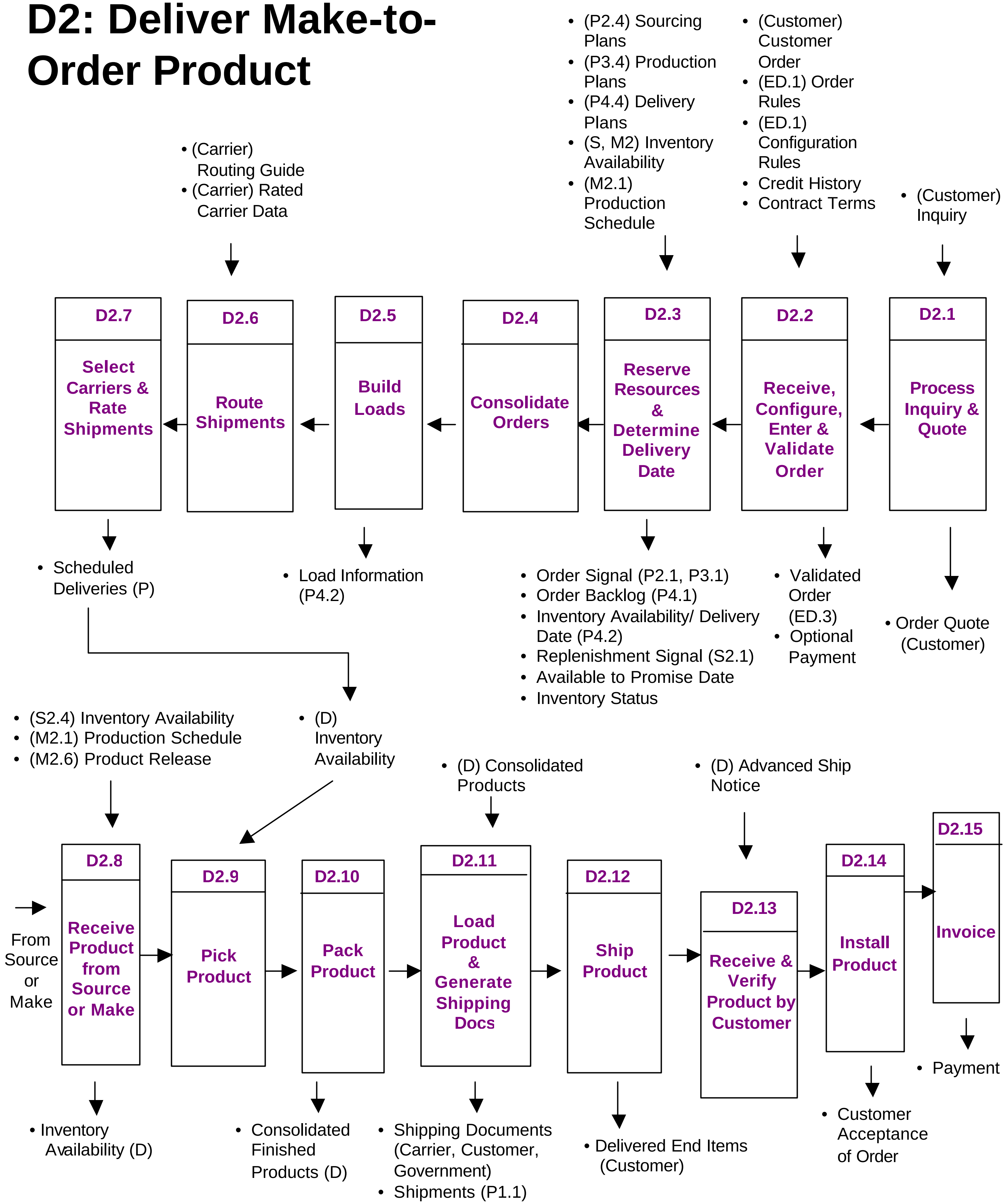
Outputs	Plan	Source	Make	Deliver	Return
Customer Acceptance of Order				D	

Process Element: Invoice	Process Element Number: D1.15
Process Element Definition	
A signal is sent to the financial organization that the order has been shipped and that the billing process should begin and payment be received or be closed out if payment has already been received. Payment is received from the customer within the payment terms of the invoice.	
Performance Attributes	**Metric**
Reliability	% Faultless Invoices
Responsiveness	Invoice Cycle Time
Flexibility	None Identified
Cost	Customer Invoicing/Accounting Costs
Assets	None Identified
Best Practices	**Features**
Utilize EDI and EFT for payment to speed closing of receivables and to reduce processing costs	EDI transaction and network services
Provide visibility to and quickly escalate delinquent accounts for resolution	Integrated accounts receivables
Electronic transfer of shipment information to finance	None Identified

Inputs	Plan	Source	Make	Deliver	Return

Outputs	Plan	Source	Make	Deliver	Return
Payment					

D2: Deliver Make-to-Order Product



Process Category: Deliver Make-to-Order Product	Process Number: D2
Process Category Definition	
The process of delivering product that is manufactured, assembled or configured from standard parts or subassemblies. Manufacture, assembly or configuration will begins only after the receipt and validation of a firm customer order.	
Performance Attributes	**Metric**
Reliability	Perfect Order Fulfillment
Responsiveness	Deliver Cycle Time
Flexibility	Upside Deliver Flexibility Downside Deliver Adaptability Upside Deliver Adaptability
Cost	Order Management Costs as % of Deliver cost
Assets	Cash to Cash Cycle Time Return on Supply Chain Fixed Assets
Best Practices	**Features**
None Identified	None Identified

Process Element: Process Inquiry & Quote	Process Element Number: D2.1
Process Element Definition	
Receive and respond to general customer inquiries and requests for quotes.	
Performance Attributes	**Metric**
Reliability	# Call Backs As % Of Total Inquiries
Responsiveness	None Identified
Flexibility	None Identified
Cost	Cost / type of Inquiry & Quote
Assets	None Identified
Best Practices	**Features**
Quote capability, without reserving inventory, which can be converted into an order in a single step	None Identified
Quote capability, without reserving inventory, which can be converted into an order, but does not generate build signal or reserve inventory capacity	None Identified
Single point of contact for all order inquiries (including order entry)	None Identified

Inputs	Plan	Source	Make	Deliver	Return
(Customer) Inquiry					

Outputs	Plan	Source	Make	Deliver	Return
Order Quote (Customer)					

Process Element: Receive, Configure, Enter & Validate Order	Process Element Number: D2.2
Process Element Definition	
Receive orders from the customer and enter them into a company's order processing system. Orders can be received through phone, fax, or through electronic media. Configure your product to the customer's specific needs, based on standard available parts or options. "Technically" examine order to ensure an orderable configuration and provide accurate price. Check the customer's credit. Optionally accept payment.	
Performance Attributes	**Metric**
Reliability	None Identified
Responsiveness	Receive, Configure, Enter and Validate Order Cycle Time
Flexibility	None Identified
Cost	Order cost / type of order Order Entry and Maintenance Costs as % of (S+M+D) cost
Assets	None Identified
Best Practices	**Features**
Electronic Commerce (customer visibility of stock availability, use of hand-held terminals for direct order entry, confirmation, credit approval), On-line stock check and reservation of inventory	EDI applications and integrated order management
Order entry is organized by customer segment Customers receive differentiated service based on volume of business Customer team is empowered to fully service customer requests, including formal orders and ad hoc requests Customers have one point of contact for all products	None Identified
Enable real-time visibility into backlog, order status, shipments, scheduled material receipts, customer credit history, and current inventory positions	None Identified
Continuous Replenishment Programs; Vendor Managed Inventory, Telemetry to automatically communicate replenishment of chemicals	Integrated demand/deployment planning to customer location driven by POS; Customer movement data
Remote (sales, customers) order entry capability	None Identified
Automatic Multi-level Credit Checking: Dollar Limits; Days Sales Outstanding; Margin Testing	Integrated Order/Financial Management
Value Pricing based on "Cost to Serve"; EDLP; Cost Plus Pricing	Activity Based Costing; Integrated Order Management by Customer by Line Item
Automated Configuration Management	Configuration

Inputs	Plan	Source	Make	Deliver	Return
(Customer) Customer Order					
Order Rules				ED.1	
Configuration Rules				ED.1	
Credit History					
Contract Terms					

Outputs	Plan	Source	Make	Deliver	Return
Validated Order				ED.3	
Optional Payment					

Process Element: Reserve Resources & Determine Delivery Date	Process Element Number: D2.3
Process Element Definition	
Inventory and/or planned capacity (both on hand and scheduled) is identified and reserved for specific orders and a delivery date is committed and scheduled.	
Performance Attributes	**Metric**
Reliability	Delivery Performance To Customer Commit Date
Responsiveness	Reserve Resources and Determine Delivery Date Cycle Time
Flexibility	None Identified
Cost	Finished Goods Inventory Days of Supply
Assets	Capacity Utilization
Best Practices	**Features**
Dynamic deployment based on constraint based planning and optimal scheduling	Advanced planning and scheduling logic with constraint, cost, and resource optimization
Automatic reservation of inventory and dynamic sourcing of product for single shipment to customer	Integrated order management system that treats each order line as a separate order with integration to inventory source and status; Real-time inventory management
ATP and Product Reservation	Integration with scheduling and inventory management

Inputs	Plan	Source	Make	Deliver	Return
Sourcing Plans	P2.4				
Production Plans	P3.4				
Delivery Plans	P4.4				
Inventory Availability		S	M2		
Production Schedule			M2.1		

Outputs	Plan	Source	Make	Deliver	Return
Order Signal	P2.1, P3.1				
Order Backlog	P4.1				
Inventory Availability/Delivery Date	P4.2				
Replenishment Signal		S2.1			
Available to Promise Date			M		
Inventory Status	P	S	M	D	

Process Element: Consolidate Orders	Process Element Number: D2.4
Process Element Definition	
The process of analyzing orders to determine the groupings that result in least cost/best service fulfillment and transportation.	
Performance Attributes	**Metric**
Reliability	None Identified
Responsiveness	Consolidate Orders Cycle Time
Flexibility	None Identified
Cost	Transportation Costs
Assets	None Identified
Best Practices	**Features**
Consolidate orders by customer, source, traffic lane, carrier, etc.	Integrated load planning and building with warehouse management

Inputs	Plan	Source	Make	Deliver	Return

Outputs	Plan	Source	Make	Deliver	Return

Process Element: Build Loads	Process Element Number: D2.5
Process Element Definition	
Transportation modes are selected and efficient loads are built.	
Performance Attributes	**Metric**
Reliability	None Identified
Responsiveness	Build Loads Cycle Time
Flexibility	None Identified
Cost	Transportation Costs
Assets	None Identified
Best Practices	**Features**
Consolidation of inbound and outbound requirements	Integrated inbound/outbound transportation planning
Build load in stop sequence (i.e. 1st truck destination loaded last, etc.)	Same as above
CRP & VMI loads optimized for utilization	Integration with CRP/VMI vendor systems
Vendor Managed Inventory (VMI)	See Glossary

Inputs	Plan	Source	Make	Deliver	Return

Outputs	Plan	Source	Make	Deliver	Return
Load Information	P4.2				

Process Element: Route Shipments	Process Element Number: D2.6
Process Element Definition	
Loads are consolidated and routed by mode, lane, and location.	
Performance Attributes	**Metric**
Reliability	None Identified
Responsiveness	Route Shipments Cycle Time
Flexibility	None Identified
Cost	Transportation Costs
Assets	None Identified
Best Practices	**Features**
CRP/VMI	Integrated Load Building; Routing & Scheduling with Advanced Ship Notice (ASN)
Consolidation of Carriers	Transportation Modeling and Rate Analysis
Carrier/Route Optimization based on continuous movement and consolidation/pooling	Route scheduling, carrier selection, and rating
Shipment tracking and tracing	Satellite communications & GPS
Vendor Managed Inventory (VMI)	See Glossary

Inputs	Plan	Source	Make	Deliver	Return
(Carrier) Routing Guide					
(Carrier) Rated Carrier Data					

Outputs	Plan	Source	Make	Deliver	Return

Process Element: Select Carriers & Rate Shipments	Process Element Number: D2.7
Process Element Definition	
Specific carriers are selected by lowest cost per route and shipments are rated and tendered.	
Performance Attributes	**Metric**
Reliability	None Identified
Responsiveness	Select Carriers and Rate Shipments Cycle Time
Flexibility	None Identified
Cost	Transportation Costs
Assets	None Identified
Best Practices	**Features**
Select carriers by least cost per shipment and rate using actual rates prior to release to billing	Rules based carrier selection and actual rate database

Inputs	Plan	Source	Make	Deliver	Return

Outputs	Plan	Source	Make	Deliver	Return
Scheduled Deliveries	P				

Process Element: Receive Product from Source or Make	Process Element Number: D2.8
Process Element Definition	
The activities such as receiving product, verifying, recording product receipt, determining put-away location, putting away and recording location for goods received from either Make or Source. May include quality inspection.	
Performance Attributes	**Metric**
Reliability	None Identified
Responsiveness	Receive Product from Make/Source Cycle Time
Flexibility	None Identified
Cost	Receiving costs / type of receipt
Assets	Finished Goods Inventory Days of Supply Inventory Obsolescence as a % of Total Inventory End-of-Life Inventory
Best Practices	**Features**
Automatic Identification	Bar Coding & Radio Frequency Communications
Download P.O. & Advanced Ship Notices for Automated Receiving and Put away	Integration with Procurement Systems & Electronic Commerce with Vendors
Dynamic location assignment including lot control, zoned put away, quality assurance, ABC frequency of access	Real time inventory control, stock locator, and rules based put away logic

Inputs	Plan	Source	Make	Deliver	Return
Inventory Availability		S2.4			
Production Schedule			M2.1		
Product Release			M2.6		

Outputs	Plan	Source	Make	Deliver	Return
Inventory Availability				D	

Process Element: Pick Product	Process Element Number: D2.9
Process Element Definition	
The series of activities including retrieving orders to pick, verifying inventory availability, building the pick wave, picking the product, recording the pick and delivering product to packing area in response to an order.	
Performance Attributes	**Metric**
Reliability	On Time In Full Documentation
Responsiveness	Pick Product Cycle Time
Flexibility	None Identified
Cost	Product Picking Cost / type of order
Assets	None Identified
Best Practices	**Features**
Dynamic simulation of picking requirements optimized for labor, cost, and time	Rules based picking logic and simulation
Dynamic location assignment including lot control, zoned picking, quality assurance	Real time inventory control, stock locator, and rules based picking logic
Use of speed racks for automated material handling	None Identified

Inputs	Plan	Source	Make	Deliver	Return
Scheduled Deliveries	P				
Inventory Availability				D	

Outputs	Plan	Source	Make	Deliver	Return

Process Element: Pack Product	Process Element Number: D2.10
Process Element Definition	
The activities such as sorting / combining the products, packing / kitting the products, paste labels, barcodes etc. and delivering the products to the shipping area for loading.	
Performance Attributes	**Metric**
Reliability	None Identified
Responsiveness	Pack product cycle time
Flexibility	None Identified
Cost	Product Packing Cost / type of order
Assets	None Identified
Best Practices	**Features**
Postponement strategies	Postponement of final configuration to the nearest point to the customer. For example pack country-specific documentation with generic finished product to create country-specific finished good to be shipped.

Inputs	Plan	Source	Make	Deliver	Return

Outputs	Plan	Source	Make	Deliver	Return
Consolidated Finished Products				D	

Process Element: Load Product & Generate Shipping Documentation	Process Element Number: D2.11
Process Element Definition	
The series of tasks including placing/loading product onto modes of transportation, and generating the documentation necessary to meet internal, customer, carrier and government needs. Shipping documentation includes the invoice. Optionally verify customer credit.	
Performance Attributes	**Metric**
Reliability	Delivery Performance to Customer Commit Date
Responsiveness	Load Vehicle and Generate Shipping Documentation Cycle Time
Flexibility	None Identified
Cost	Loading costs / type of load
Assets	Field Finished Goods Inventory Days of Supply
Best Practices	**Features**
Advanced Shipping Notices & UCC128 container labeling	Bar coding; EDI; integrated transportation/warehouse management
Integrated Credit Checking	Interface to supplier's shipping system to financials
Electronic generation and download of shipping documents	None Identified
Full visibility of credit history by shipping personnel	None Identified
Supplier (Carrier) Agreements	See Glossary

Inputs	Plan	Source	Make	Deliver	Return
Consolidated Products				D	

Outputs	Plan	Source	Make	Deliver	Return
Shipping Documents (Carrier, Customer, Government)					
Shipments	P1.1				

Process Element: Ship Product	Process Element Number: D2.12
Process Element Definition	
The process of shipping the product to the customer site.	
Performance Attributes	**Metric**
Reliability	None Identified
Responsiveness	Ship Product Cycle Time
Flexibility	None Identified
Cost	None Identified
Assets	None Identified
Best Practices	**Features**
Shipment Tracking	None Identified

Inputs	Plan	Source	Make	Deliver	Return

Outputs	Plan	Source	Make	Deliver	Return
Delivered End Items (Customer)				D	

Process Element: Receive & Verify Product by Customer	Process Element Number: D2.13
Process Element Definition	
The process of receiving the shipment at the customer (either at customer site or at shipping area in case of self-collection) and verifying that the order was shipped complete and that the product meets delivery terms.	
Performance Attributes	**Metric**
Reliability	None Identified
Responsiveness	Receive and Verify Product Cycle Time
Flexibility	None Identified
Cost	Receive & Verify cost / type of receipt Cost of non-conformance
Assets	None Identified
Best Practices	**Features**
Advanced Shipping Notices & UCC128 container labeling	Bar coding; EDI; integrated transportation/warehouse management
Shipment Tracking	None Identified

Inputs	Plan	Source	Make	Deliver	Return
Advanced Ship Notice				D	

Outputs	Plan	Source	Make	Deliver	Return

Process Element: Install Product	Process Element Number: D2.14
Process Element Definition	
When necessary, the process of preparing, testing and installing the product at the customer site. The product is fully functional upon completion.	
Performance Attributes	**Metric**
Reliability	% Faultless Installations
Responsiveness	Install Product Cycle Time
Flexibility	None Identified
Cost	Product Install cost / type of installation
Assets	Field Finished Goods Inventory Days of Supply
Best Practices	**Features**
Joint Service Agreements to document acceptable service levels in terms of installation costs, installation cycle time, etc. This would be effective between customer and supplier, and between internal functions such as Field Service, Manufacturing, Marketing and Order Management	None Identified

Inputs	Plan	Source	Make	Deliver	Return

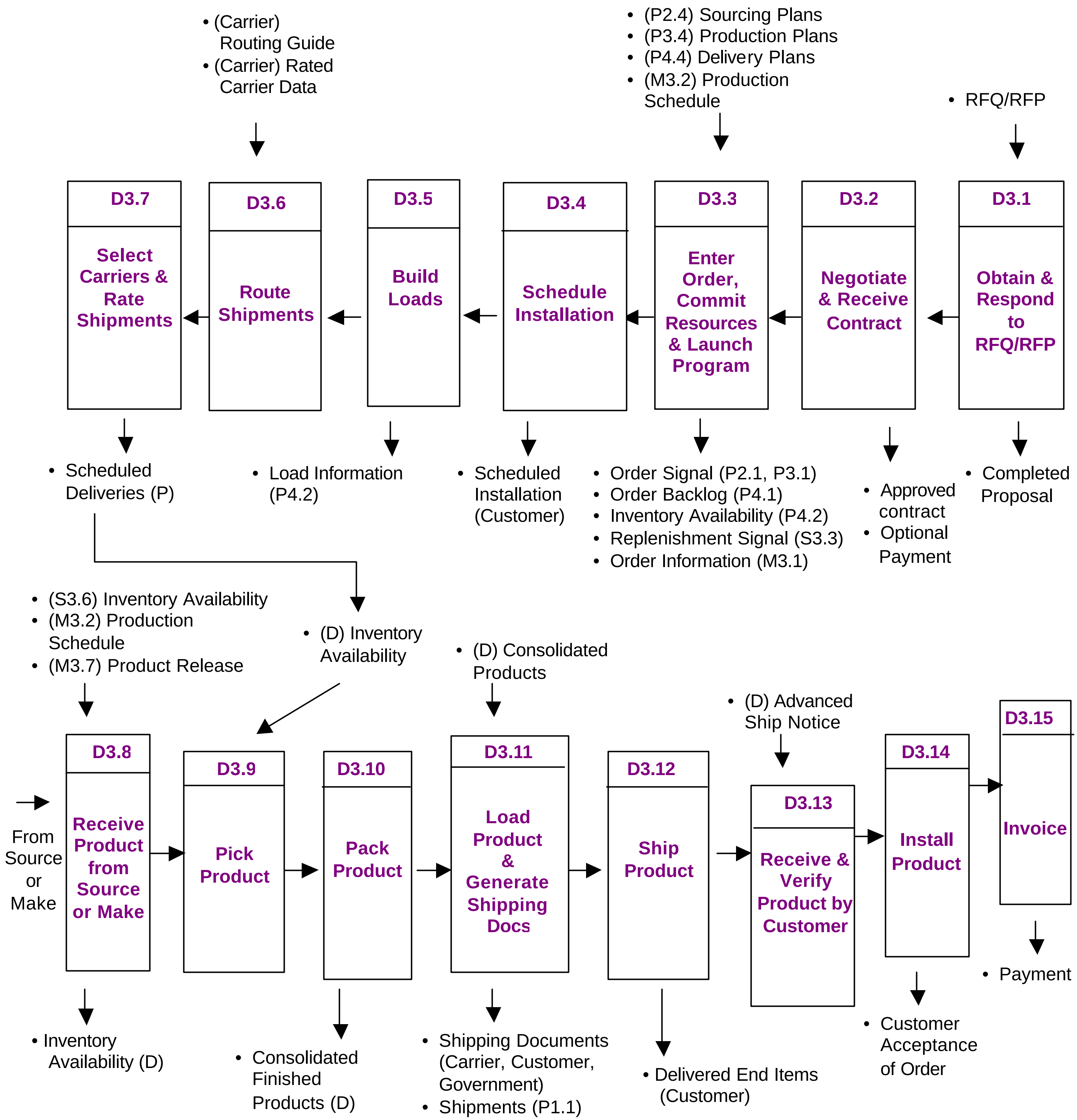
Outputs	Plan	Source	Make	Deliver	Return
Customer Acceptance of Order					

Process Element: Invoice	Process Element Number: D2.15
Process Element Definition	
A signal is sent to the financial organization that the order has been shipped and that the billing process should begin and payment be received or be closed out if payment has already been received. Payment is received from the customer within the payment terms of the invoice.	
Performance Attributes	**Metric**
Reliability	% Faultless Invoices
Responsiveness	Invoice Cycle Time
Flexibility	None Identified
Cost	Customer Invoicing/Accounting Costs
Assets	None Identified
Best Practices	**Features**
Utilize EDI and EFT for payment to speed closing of receivables and to reduce processing costs	EDI transaction and network services
Provide visibility to and quickly escalate delinquent accounts for resolution	Integrated accounts receivables
Electronic transfer of shipment information to finance	None Identified

Inputs	Plan	Source	Make	Deliver	Return

Outputs	Plan	Source	Make	Deliver	Return
Payment					

D3: Deliver Engineer-to-Order Product



Process Category: Deliver Engineer-to-Order Product	Process Number: D3
Process Category Definition	
The process of delivering a product that is designed, manufactured, and assembled from a bill of materials that includes one or more custom parts. Design will begin only after the receipt and validation of a firm customer order.	
Performance Attributes	**Metric**
Reliability	Perfect Order Fulfillment
Responsiveness	Deliver Cycle Time
Flexibility	Upside Deliver Flexibility Downside Deliver Adaptability Upside Deliver Adaptability
Cost	Order Management Costs as % of Deliver cost
Assets	Cash to Cash Cycle Time Return on Supply Chain Fixed Assets
Best Practices	**Features**
None Identified	None Identified

Process Element: Obtain and Respond to Request for Quote (RFQ) / Request for Proposal (RFP)	Process Element Number: D3.1
Process Element Definition	
The process of receiving a request for proposal or request for quote, evaluating the request (estimating the schedule, developing costs estimates, establishing price), and responding to the potential customer.	
Performance Attributes	**Metric**
Reliability	None Identified
Responsiveness	None Identified
Flexibility	None Identified
Cost	Cost / RFP (or RFQ)
Assets	None Identified
Best Practices	**Features**
Use of CAD/CAE applications to simulate design, cost and manufacturing process	None Identified
Partnership with outside design firms to provide skills and capacity, as needed	None Identified

Inputs	Plan	Source	Make	Deliver	Return
RFQ/RFP					

Outputs	Plan	Source	Make	Deliver	Return
Completed Proposal					

Process Element: Negotiate & Receive Contract	Process Element Number: D3.2
Process Element Definition	
The process of negotiating order details with customer (eg, price, schedule, product performance) and finalizing the contract. Optionally accept payment.	
Performance Attributes	**Metric**
Reliability	None Identified
Responsiveness	None Identified
Flexibility	None Identified
Cost	Negotiating cost / type of contract
Assets	None Identified
Best Practices	**Features**
None Identified	None Identified

Inputs	Plan	Source	Make	Deliver	Return

Outputs	Plan	Source	Make	Deliver	Return
Approved Contract					
Optional Payment					

Process Element: Enter Order, Commit Resources & Launch Program	Process Element Number: D3.3
Process Element Definition	
The process of entering/finalizing the customers order, approving the planned resources (e.g., engineering, manufacturing, etc.) and officially launching the program.	
Performance Attributes	**Metric**
Reliability	None Identified
Responsiveness	Enter Order, Commit Resources and Launch Program Cycle Time
Flexibility	None Identified
Cost	Order, Commit, & Launch costs / type of order
Assets	None Identified
Best Practices	**Features**
None Identified	None Identified

Inputs	Plan	Source	Make	Deliver	Return
Sourcing Plans	P2.4				
Production Plans	P3.4				
Delivery Plans	P4.4				
Production Schedule			M3.2		

Outputs	Plan	Source	Make	Deliver	Return
Order Signal	P2.1, P3.1				
Order Backlog	P4.1				
Resource Availability	P4.2				
Replenishment Signal		S3.3			
Order Information			M3.1		

Process Element: Schedule Installation	Process Element Number: D3.4
Process Element Definition	
The process of evaluating the design and build schedules relative to customer requested installation date to determine installation schedule.	
Performance Attributes	**Metric**
Reliability	None Identified
Responsiveness	Schedule Installation Cycle Time
Flexibility	None Identified
Cost	Schedule Installation cost / type of order
Assets	None Identified
Best Practices	**Features**
None Identified	None Identified

Inputs	Plan	Source	Make	Deliver	Return

Outputs	Plan	Source	Make	Deliver	Return
Scheduled Installation (Customer)					

Process Element: Build Loads	Process Element Number: D3.5
Process Element Definition	
Transportation modes are selected and efficient loads are built.	
Performance Attributes	**Metric**
Reliability	None Identified
Responsiveness	Build Loads Cycle Time
Flexibility	None Identified
Cost	Transportation Costs
Assets	None Identified
Best Practices	**Features**
Consolidation of inbound and outbound requirements	Integrated inbound/outbound transportation planning
Build load in stop sequence (i.e. 1st truck destination loaded last, etc.)	Same as above
CRP & VMI loads optimized for utilization	Integration with CRP/VMI vendor systems
Vendor Managed Inventory (VMI)	See Glossary

Inputs	Plan	Source	Make	Deliver	Return

Outputs	Plan	Source	Make	Deliver	Return
Load Information	P4.2				

Process Element: Route Shipments	Process Element Number: D3.6
Process Element Definition	
Loads are consolidated and routed by mode, lane, and location.	
Performance Attributes	**Metric**
Reliability	None Identified
Responsiveness	Route Shipments Cycle Time
Flexibility	None Identified
Cost	Distribution Costs
Assets	None Identified
Best Practices	**Features**
CRP/VMI	Integrated Load Building; Routing & Scheduling with Advanced Ship Notice (ASN)
Consolidation of Carriers	Transportation Modeling and Rate Analysis
Carrier/Route Optimization based on continuous movement and consolidation/pooling	Route scheduling, carrier selection, and rating
Shipment tracking and tracing	Satellite communications & GPS
Vendor Managed Inventory (VMI)	See Glossary

Inputs	Plan	Source	Make	Deliver	Return
(Carrier) Routing Guide					
(Carrier) Rated Carrier Data					

Outputs	Plan	Source	Make	Deliver	Return

_Process Element: Select Carriers & Rate Shipments	__Process Element Number: D3.7_
Process Element Definition	
Specific carriers are selected by lowest cost per route and shipments are rated and tendered.	
Performance Attributes	**Metric**
Reliability	None Identified
Responsiveness	Select Carriers and Rate Shipments Cycle Time
Flexibility	None Identified
Cost	Transportation Costs
Assets	None Identified
Best Practices	**Features**
Select carriers by least cost per shipment and rate using actual rates prior to release to billing	Rules based carrier selection and actual rate database

Inputs	Plan	Source	Make	Deliver	Return

Outputs	Plan	Source	Make	Deliver	Return
Scheduled Deliveries	P				

Process Element: Receive Product from Source or Make	**Process Element Number: D3.8**
Process Element Definition	
The activities such as receiving product, verifying, recording product receipt, determining put-away location, putting away and recording location for goods received from either Make or Source. May include quality inspection.	
Performance Attributes	**Metric**
Reliability	None Identified
Responsiveness	Receive Product from Make/Source Cycle Time
Flexibility	None Identified
Cost	Receiving costs / type of receipt
Assets	Finished Goods Inventory Days of Supply Inventory Obsolescence as a % of Total Inventory End-of-Life Inventory
Best Practices	**Features**
Automatic Identification	Bar Coding & Radio Frequency Communications
Download P.O. & Advanced Ship Notices for Automated Receiving and Put away	Integration with Procurement Systems & Electronic Commerce with Vendors
Dynamic location assignment including lot control, zoned put away, quality assurance, ABC frequency of access	Real time inventory control, stock locator, and rules based put away logic

Inputs	Plan	Source	Make	Deliver	Return
Inventory Availability		S3.6			
Production Schedule			M3.2		
Product Release			M3.7		

Outputs	Plan	Source	Make	Deliver	Return
Inventory Availability				D	

Process Element: Pick Product	Process Element Number: D3.9
Process Element Definition	
The series of activities including retrieving orders to pick, verifying inventory availability, building the pick wave, picking the product, recording the pick and delivering product to packing area in response to an order.	
Performance Attributes	**Metric**
Reliability	None Identified
Responsiveness	Pick Product Cycle Time
Flexibility	None Identified
Cost	Product Picking Cost / type of order
Assets	Finished Goods Inventory Days of Supply
Best Practices	**Features**
Dynamic simulation of picking requirements optimized for labor, cost, and time	Rules based picking logic and simulation
Dynamic location assignment including lot control, zoned picking, quality assurance	Real time inventory control, stock locator, and rules based picking logic

Inputs	Plan	Source	Make	Deliver	Return
Scheduled Deliveries	P				
Inventory Availability				D	

Outputs	Plan	Source	Make	Deliver	Return

Process Element: Pack Product	Process Element Number: D3.10
Process Element Definition	
The activities such as sorting / combining the products, packing / kitting the products, paste labels, barcodes etc. and delivering the products to the shipping area for loading.	
Performance Attributes	**Metric**
Reliability	None Identified
Responsiveness	Pack Product Cycle Time
Flexibility	None Identified
Cost	Product Packing Cost / type of order
Assets	None Identified
Best Practices	**Features**
Postponement strategies	Postponement of final configuration to the nearest point to the customer. For example pack country-specific documentation with generic finished product to create country-specific finished good to be shipped.

Inputs	Plan	Source	Make	Deliver	Return

Outputs	Plan	Source	Make	Deliver	Return
Consolidated Finished Products				D	

Process Element: Load Product & Generate Shipping Documentation	Process Element Number: D3.11
Process Element Definition	
The series of tasks including placing/loading product onto modes of transportation, and generating the documentation necessary to meet internal, customer, carrier and government needs. Shipping documentation includes the invoice. Optionally verify customer credit.	
Performance Attributes	**Metric**
Reliability	Delivery Performance to Customer Commit Date
Responsiveness	Load Vehicle and Generate Shipping Documentation Cycle Time
Flexibility	None Identified
Cost	Loading cost / type of load
Assets	Finished Goods Inventory Days of Supply
Best Practices	**Features**
Advanced Shipping Notices & UCC128 container labeling	Bar coding; EDI; integrated transportation/warehouse management
Integrated Credit Checking	Interface to supplier's shipping system to financials
Electronic generation and download of shipping documents	None Identified
Full visibility of credit history by shipping personnel	None Identified
Supplier (Carrier) Agreements	See Glossary

Inputs	Plan	Source	Make	Deliver	Return
Consolidated Products				D	

Outputs	Plan	Source	Make	Deliver	Return
Shipping Documents (Carrier, Customer, Government)					
Shipments	P1.1				

Process Element: Ship Product	Process Element Number: D3.12
Process Element Definition	
The process of shipping the product to the customer site.	
Performance Attributes	**Metric**
Reliability	None Identified
Responsiveness	Ship Product Cycle Time
Flexibility	None Identified
Cost	None Identified
Assets	None Identified
Best Practices	**Features**
Shipment Tracking	None Identified

Inputs	Plan	Source	Make	Deliver	Return

Outputs	Plan	Source	Make	Deliver	Return
Delivered End Items (Customer)				D	

Process Element: Receive & Verify Product by Customer	Process Element Number: D3.13
Process Element Definition	
The process of receiving the shipment (either at customer site or at shipping area in case of self-collection) and verifying that the order was shipped complete and that the product meets delivery terms.	
Performance Attributes	**Metric**
Reliability	None Identified
Responsiveness	Receive and Verify Product Cycle Time
Flexibility	None Identified
Cost	Receive & Verify cost / type of receipt Cost of non-conformance
Assets	None Identified
Best Practices	**Features**
Advanced Shipping Notices & UCC128 container labeling	Bar coding; EDI; integrated transportation/warehouse management
Shipment Tracking	None Identified

Inputs	Plan	Source	Make	Deliver	Return
Advanced Ship Notice				D	

Outputs	Plan	Source	Make	Deliver	Return

Process Element: Install Product	Process Element Number: D3.14
Process Element Definition	
The process of preparing, testing and installing the product at the customer site. The product is fully functional upon completion.	
Performance Attributes	**Metric**
Reliability	% Faultless Installations
Responsiveness	Install Product Cycle Time
Flexibility	None Identified
Cost	Install cost / type of installation
Assets	Field Finished Goods Inventory Days of Supply
Best Practices	**Features**
None Identified	None Identified

Inputs	Plan	Source	Make	Deliver	Return

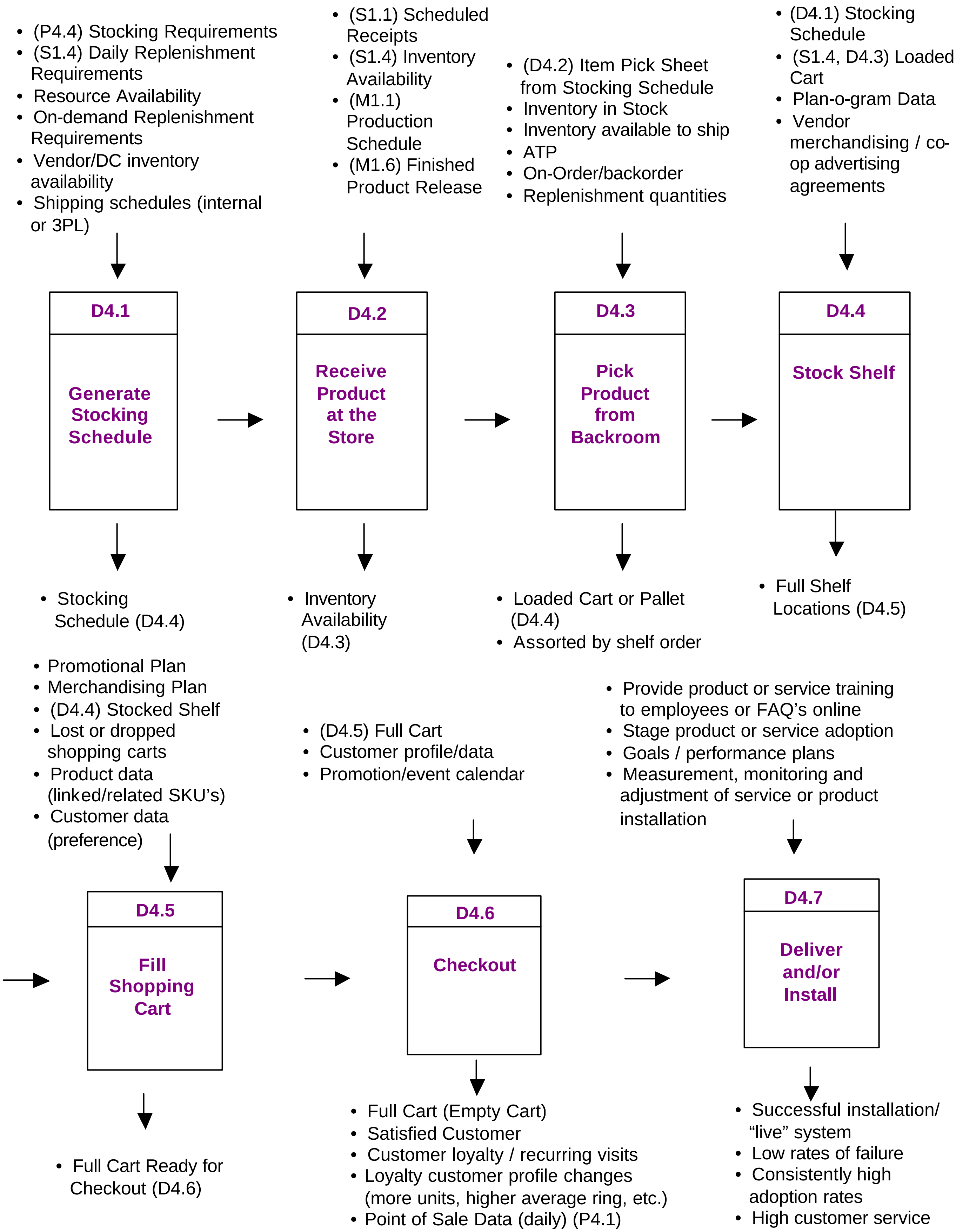
Outputs	Plan	Source	Make	Deliver	Return
Customer Acceptance of Order					

Process Element: Invoice	Process Element Number: D3.15
Process Element Definition	
A signal is sent to the financial organization that the order has been shipped and that the billing process should begin and payment be received or be closed out if payment has already been received. Payment is received from the customer within the payment terms of the invoice.	
Performance Attributes	**Metric**
Reliability	% Faultless Invoices
Responsiveness	Invoice Cycle Time
Flexibility	None Identified
Cost	Customer Invoicing/Accounting Costs
Assets	None Identified
Best Practices	**Features**
Utilize EDI and EFT for payment to speed closing of receivables and to reduce processing costs	EDI transaction and network services
Provide visibility to and quickly escalate delinquent accounts for resolution	Integrated accounts receivables
Electronic transfer of shipment information to finance	None Identified

Inputs	Plan	Source	Make	Deliver	Return

Outputs	Plan	Source	Make	Deliver	Return
Payment					

D4: Deliver Retail Product



Process Category: Deliver Retail Product	Process Number: D4
Process Category Definition	
Deliver Retail Products are the processes used to acquire, merchandise, and sell finished goods at a retail store. A retail store is a physical location that sells products (and services) direct to the consumer using a point of sale process (manual or automated) to collect payment. Merchandising at a store level is the stocking and restocking of products in designated storage locations to generate sales in a retail store.	
Performance Attributes	**Metric**
Reliability	Shelf Stock Out % Replenishment Accuracy Replenishment Timeliness Shelf Space To Market Share Ratio
Responsiveness	Deliver Retail Cycle Time
Flexibility	Service Levels / Accuracy
Cost	Deliver Retail Store Cost as % of Sales
Assets	Cash to Cash Cycle Time Days of Stock in Retail Return on Supply Chain Fixed Assets
Best Practices	**Features**
None Identified	None Identified

Process Element: Generate Stocking Schedule	Process Element Number: D4.1
Process Element Definition	
The process of scheduling resources to support item-stocking requirements.	
Performance Attributes	**Metric**
Reliability	None Identified
Responsiveness	Generate Stocking Schedule Cycle Time
Flexibility	Cost efficiency/elasticity of shipping schedules
Cost	Number of Items stocked per FTE Stocking resource costs as % of Deliver cost
Assets	None Identified
Best Practices	**Features**
Automated pick list	System generated pick-lists based on picking / batching rules
Push product on trailer arrival	System prioritization of items coming off trucks vs. picked from back room
Labor scheduling that matches product flow	Workforce management solution with flexible rules

Inputs	Plan	Source	Make	Deliver	Return
Stocking Requirements	P4.4				
Daily Replenishment Requirements		S1.4			
Resource Availability					
On-demand Replenishment Requirements					
Vendor/DC inventory availability					
Shipping schedules (internal or 3PL)					

Outputs	Plan	Source	Make	Deliver	Return
Stocking Schedule				D4.4	

Process Element: Receive Product at the Store	Process Element Number: D4.2
Process Element Definition	
The activities such as receiving product, verifying, recording product receipt, determining put-away location, putting away and recording location that a company performs at its own stores. May include quality inspection.	
Performance Attributes	**Metric**
Reliability	None Identified
Responsiveness	Receive Product Cycle Time
Flexibility	Cost efficiency/elasticity of shipping schedules
Cost	Receiving Product costs as % of Deliver cost
Assets	None Identified
Best Practices	**Features**
Automated pick list	System generated pick-lists based on picking / batching rules
Push product on trailer arrival	System prioritization of items coming off trucks vs. picked from back room
Labor scheduling that matches product flow	Workforce management solution with flexible rules

Inputs	Plan	Source	Make	Deliver	Return
Scheduled Receipts		S1.1			
Inventory Availability		S1.4			
Production Schedule			M1.1		
Finished Product Release			M1.6		

Outputs	Plan	Source	Make	Deliver	Return
Inventory Availability				D4.3	

Process Element: Pick Product from Backroom	Process Element Number: D4.3
Process Element Definition	
The process of retrieving restocking orders to pick, determining inventory availability, building a pick wave, picking item and quantity from a designated backroom warehouse location, recording the resulting inventory transaction, and delivering the product to point of stock.	
Performance Attributes	**Metric**
Reliability	Inventory inaccuracies during pick-process
Responsiveness	Pick Product Cycle Time
Flexibility	None Identified
Cost	Backroom Picking costs as % of Deliver cost Backroom Picking cost / restocking order
Assets	None Identified
Best Practices	**Features**
Automated directed picking	A pick list displayed on a handheld device that directs picks and relieves inventory from backroom locations
Staging based on in-store zones	Items are staged for re-stocking based on zones within the store. This minimizes restocking effort.
Automated Replenishment of back stock based on min-stocking levels	None Identified
Defined stocking levels & criteria	None Identified

Inputs	Plan	Source	Make	Deliver	Return
Item Pick Sheet from Stocking Schedule				D4.2	
Inventory in Stock					
Inventory available to ship					
ATP					
On-Order/backorder					
Replenishment Quantities					

Outputs	Plan	Source	Make	Deliver	Return
Loaded Cart or Pallet				D4.4	
Assorted by Shelf Order					

Process Element: Stock Shelf	Process Element Number: D4.4
Process Element Definition	
For restocks, the tasks associated with identifying the item location, stocking the shelf according to merchandise plans, and recording the appropriate inventory transaction. For promotional items and stock repositioning the tasks associated with shelf and point of sale preparation, stock placement, and end of sale activities.	
Performance Attributes	**Metric**
Reliability	Requirements fill % In-stock %
Responsiveness	Stock Shelf Cycle Time
Flexibility	None Identified
Cost	Put-a-way Labor Cost – Includes internal and/or external contract costs as % of Deliver cost
Assets	In Store Inventory Accuracy
Best Practices	**Features**
Stocking is completed in zones	Each area of the store has its own stocking plan and items are routed specifically to that area
Off peak stocking	The majority of stocking is completed with minimal impact to or visibility from the customer
Item/shelf scanning upon put-a-way	Scan store shelves / bar codes to confirm put-a-way
Proof of performance (promotion management)	Same as above—scan using handheld and match with ad
Scan displays for promo conformance	

Inputs	Plan	Source	Make	Deliver	Return
Stocking Schedule				D4.1	
Loaded Cart		S1.4		D4.3	
Plan-o-gram Data					
Vendor merchandising / co-op advertising agreements					

Outputs	Plan	Source	Make	Deliver	Return
Full Shelf Locations				D4.5	

Process Element: Fill Shopping Cart	Process Element Number: D4.5
Process Element Definition	
Typical set of tasks associated with product selection, storage and movement through to checkout.	
Performance Attributes	**Metric**
Reliability	% Item Location Accuracy
Responsiveness	Fill Shopping Cart Cycle Time
Flexibility	Rain check %
Cost	% Shrinkage
Assets	None Identified
Best Practices	**Features**
Items are relieved from inventory when item is removed from shelf	RFID, smart cart or customer self-service reduces system inventory upon item pick
Up and Cross Selling and/or Substitution	Trained staff or automated systems (Internet) that recommend up-sell, cross-sell, and/or substitution
Multiple locations throughout store	Planned and tracked via a plan-o-gram system; Location specific product labeling
Measured and compared with same activity previous period (whether it is year ago, period ago, etc.)	DSS or portal tool that shows previous period performance and comparison for store management
Loyalty card data	Use for comparison to previous sales activity/track new consumers, etc.

Inputs	Plan	Source	Make	Deliver	Return
Promotional Plan					
Merchandising Plan					
Stocked Shelf – or “full shelf locations?”				D4.4	
Lost or dropped shopping carts					
Product data (linked/related SKU’s)					
Customer data (preference)					

Outputs	Plan	Source	Make	Deliver	Return
Full Cart Ready for Checkout				D4.6	

Process Element: Checkout	Process Element Number: D4.6
Process Element Definition	
The processes and tasks associated with product checkout including scanning, method of payment, credit application and approval, service agreement, order confirmation, and/or invoice or receipt.	
Performance Attributes	**Metric**
Reliability	Price checks per cashier shift
Responsiveness	Checkout Cycle Time
Flexibility	None Identified
Cost	Checkout labor - % sales Checkout cost / checkout event
Assets	None Identified
Best Practices	**Features**
Automatic customer payment	RFID, smart cart or customer self-service charges goods to card upon store departure
Customer profile drives recognition upon checkout	None Identified
Notification of existing/future events or promotions	None Identified

Inputs	Plan	Source	Make	Deliver	Return
Full Cart				D4.5	
Customer profile/data					
Promotion/event calendar					

Outputs	Plan	Source	Make	Deliver	Return
Full Cart (Empty Cart)					
Satisfied Customer					
Customer loyalty / recurring visits					
Loyalty customer profile changes (more units, higher average ring, etc.)					
Point of Sale Data (daily)	P4.1				

Process Element: Deliver and/or Install	Process Element Number: D4.7
Process Element Definition	
The process of preparing and installing the product at the customer site. The product is fully functional upon completion.	
Performance Attributes	**Metric**
Reliability	% Accuracy or Failure Rates Service levels
Responsiveness	Install Cycle Time
Flexibility	Adoption rates
Cost	Product Install cost / type of installation
Assets	None Identified
Best Practices	**Features**
Provide product or service training to employees or FAQ's online	None Identified
Stage product or service adoption	None Identified
Goals / performance plans	None Identified
Measurement, monitoring and adjustment of service or product installation	None Identified

Inputs	Plan	Source	Make	Deliver	Return

Outputs	Plan	Source	Make	Deliver	Return
Successful installation / "live" system					
Low rates of failure					
Consistently high adoption rates					
High customer service and satisfaction levels					

ED: Enable Deliver

Inputs to ED.1

- (ED.2) Management Process Reports
- (ED.2, ED.4, ED.6) Supply Chain Performance Metrics
- (P) Planning Decision Policies
- Configuration Rules

ED.1 – Manage Deliver Business Rules

Outputs of ED.1

- Order Rules (D1.2, D2.2, D3.2, ED.4, ED.5)
- Configuration Rules (D2.2)

Inputs to ED.2

- Benchmark Data
- (ED.4, ED.5) Delivery Performance
- (ED.8) Returns Data
- (D1.2, D2.2, D3.2) Customer Orders
- (S) Customer Carrier Contracts

ED.2 – Assess Delivery Performance

Outputs of ED.2

- Management Process Reports (ED.1)
- Supply Chain Performance Metrics (P, ED.1, ED.5)
- Customer Service Requirements (P, ED.6)

Inputs to ED.3

- (D1.2, D2.2, D3.1) Customer Address Data, Credit History, Purchase History, Contract Status, Shipping Preferences
- (D1.2, D2.2) Validated Order

ED.3 – Manage Deliver Information

Outputs of ED.3

- Customer Master Database/ Up to Date (ED.4)

Inputs to ED.4

- (P) Inventory Rules, Product Mix and Plans, Integrated Supply Chain Plan
- (D1.8) Existing Inventory Data
- (ED.8) Returns Data
- (ED.8) Scrap Authorizations
- (ED.3) Customer Master Database
- (ED.1) Order Rules

ED.4 – Manage Finished Product Inventories

Outputs of ED.4

- Inventory Target Levels (P)
- Inventory Rules (ED.5)
- Supply Chain Performance Metrics (P, ED.1, ED.5)
- Delivery Performance (ED.2)

Inputs to ED.5

- (P) Budgets, Approved Item Master
- (ED.2, ED.4) Supply Chain Performance Metrics
- (P, ED.4) Inventory Rules
- (ED.1) Order Rules

ED.5 – Manage Deliver Capital Assets

Outputs of ED.5

- Warehouse Operating Constraints (P)
- Delivery Performance (ED.2)

ED: Enable Deliver

- Air, Ground… Carrier Rate Tables
- (ED.2) Customer Service Requirements
- (P) Standard Practices/Rules
- (S) Contract Carrier Rates
- Projected Delivery Requirements (M)
- (D1.2, D2.2, D3.2) Customer Order Size, Weight & Freight Class

ED.6

Manage Transportation

- Shipping Parameters & Documentation (D1.10, D2.9, D3.8)
- Supply Chain Performance Metrics (P, ED.1)

- (P) Product Mix and Plans, Revised Business Assumptions, Budgets, Source of Products
- (D1.2, D2.2, D3.2) Location of Customers

ED.7

Manage Product Life Cycle

- Enterprise Distribution Model (P)

- Government Regulations
- (D1.10, D2.9, D3.8) Shipping History
- (S1.2, S2.2, S3.4) Receipt History
- Tariffs & Duties

ED.8

Manage Import/Export Requirements

- Shipping Export Parameters & Documentation (D1.10, D2.9, D3.8)
- Government Constraints (P, ED.7)
- Duty Drawback Claims

Enable Process: Manage Deliver Business Rules	Process Number: ED.1
Enable Process Definition	
The process of defining and maintaining rules which affect the acceptance of an order, based on quantity, method of delivery, credit, customer experience, etc. (Include distribution channel rules)	
Performance Attributes	**Metric**
Reliability	# Orders requiring intervention due to rule violation
Responsiveness	None identified
Flexibility	None identified
Cost	None identified
Assets	None Identified
Best Practices	**Features**
Integrated edit at order entry time	Customer Master Record
On-line rule base	None Identified

Inputs	Plan	Source	Make	Deliver	Return
Management Process Reports				ED.2	
Supply Chain Performance Metrics				ED.2, ED.4, ED.6	
Planning Decision Policies	P				
Configuration Rules					

Outputs	Plan	Source	Make	Deliver	Return
Order Rules				D1.2, D2.2, D3.2, ED.4, ED.5	
Configuration Rules				D2.2	

Enable Process: Access Delivery Performance	Process Number: ED.2
Enable Process Definition	
The process of defining the requirement and monitoring the performance of the delivery of product to a customer. When physical delivery is out-sourced the performance is passed on to source for contract administration.	
Performance Attributes	**Metric**
Reliability	Perfect Order Fulfillment
Responsiveness	None Identified
Flexibility	None Identified
Cost	None identified
Assets	Transportation Assets
Best Practices	**Features**
Real time package tracking	Tracking and tracing
Customer initiated package tracking	WEB based Shared systems

Inputs	Plan	Source	Make	Deliver	Return
Benchmark Data					
Delivery Performance				ED.4, ED.5	
Returns Data				ED.8	
Customer Orders				D1.2, D2.2, D3.2	
Customer Carrier Contracts		S			

Outputs	Plan	Source	Make	Deliver	Return
Management Process Reports				ED.1	
Supply Chain Performance Metrics	P			ED.1, ED.5	
Customer Service Requirements	P			ED.6	

Enable Process: Manage Deliver Information	Process Number: ED.3
Enable Process Definition	
The process of collecting, maintaining, and communicating information to support deliver planning and execution processes. The information to be managed includes: order data - (customer preference, history, status, and delivery requirements, etc.), warehouse data, transportation data, and deliver data.	
Performance Attributes	**Metric**
Reliability	Age of data - #days since last effective use Ratio of active customer data/Inactive customer data
Responsiveness	None identified
Flexibility	None Identified
Cost	None identified
Assets	None Identified
Best Practices	**Features**
Provide single source of information on the customer (Single group / owner responsible for accuracy / quality of customer data)	Secure E-Commerce Server and integrated Order Management System (OMS) Warehouse Management System (WMS) and Transportation Management System (TMS)
Online real-time customer entry and edit	On-line Customer Service Module CRM (Customer resource Management) software is getting a big push in the E-Commerce/E-Business areas and generally provides a means to fulfill this requirement
Customer access to online tracking of order status and shipping information	Internet-enabled package/shipment tracking
Comprehensive history of customer interactions including order history, claims, problems, etc.	None Identified
Customer Service data validation including geo-coding	None Identified

Inputs	Plan	Source	Make	Deliver	Return
Customer Address Data, Credit History, Purchase History, Contract Status, Shipping Preferences				D1.2, D2.2, D3.1	
Validated Order				D1.2, D2.2	

Outputs	Plan	Source	Make	Deliver	Return
Customer Master Database - Up to Date				ED.4	

Enable Process: Manage Finished Goods Inventories	Process Number: ED.4
Enable Process Definition	
The process of establishing and maintaining finished goods, inventory limits or levels, replenishment models, ownership, product mix, stocking locations	
Performance Attributes	**Metric**
Reliability	Fill Rate (% filled of an order)
Responsiveness	None Identified
Flexibility	None Identified
Cost	Inventory carrying cost $ Days of inventory
Assets	Inventory Days of Supply
Best Practices	**Features**
Periodic review of metrics and strategy with comparisons to industry benchmarks	Real time view of data.
Real time data on current status.	Dynamic calculation of safety stock based on actual sales
Inventory Cycle Counting	See Glossary

Inputs	Plan	Source	Make	Deliver	Return
Inventory Rules, Product Mix and Plans, Integrated Supply Chain Plan	P				
Existing Inventory Data				D1.8	
Returns Data				ED.8	
Scrap Authorizations				ED.8	
Customer Master Database				ED.3	
Order Rules				ED.1	

Outputs	Plan	Source	Make	Deliver	Return
Inventory Target Levels	P				
Inventory Rules				ED.5	
Supply Chain Performance Metrics	P			ED.1, ED.5	

Enable Process: Manage Deliver Capital Assets	Process Number: ED.5
Enable Process Definition	
Acquisition, maintenance, and disposition of order management, warehouse and transportation capital assets. Determine material handling (inventory) pick pack & ship methods (inventory), and equipment.	
Performance Attribute	**Metric**
Reliability	% Perfect customer order delivery % Capacity Utilization % Obsolete or inactive inventory Inventory Accuracy by location (% Items whose physical count and location matched system's count and location) % Damaged products receipts and % damaged customer shipments
Responsiveness	None Identified
Flexibility	None Identified
Cost	Warehouse Distribution Cost Inventory Carrying Cost Cost of Obsolete Inventory Cost of Damaged Inventory
Assets	Inventory turns per year Delivery Fixed Asset Costs
Best Practices	**Features**
Standard Operating Procedures and Methodology	Real-time System Directed Task Scheduling and Management
Measure Customer Service	Advanced Shipping Notices (ASN) Parcel and Container Routing and Rating Compliance Labeling Real time shipment tracking
Removal of Obsolete Stock	Automated Calculation of ABC Velocity Movement
Storage Location Zoning	Automated or Optimized Slotting (Storage Location) Systems
Facility Master Plan	Automated Item Cubing and Weighting systems
Automated Data Entry	Scanning with RFID/Bar-codes systems
Inventory Cycle Counting	See Glossary

Inputs	Plan	Source	Make	Deliver	Return
Budgets, Approved Item Master	P				
Supply Chain Performance Metrics				ED.2, ED.4	
Inventory Rules	P			ED.4	
Order Rules				ED.1	

Outputs	Plan	Source	Make	Deliver	Return
Warehouse Operating Constraints	P				
Delivery Performance				ED.2	

Enable Process: Manage Transportation	Process Number: ED.6
Enable Process Definition	
The process of 1) defining and maintaining the information which characterizes product, containerization, vehicle, route, terminals, regulations, rates/tariffs and backhaul opportunity (Characterization include information necessary to support maintenance of internal Outbound Transportation equipment – CAPITAL ASSETS) and 2) the management of transporters.	
Performance Attributes	**Metric**
Reliability	Frequency of parameter updates Number of data sources for data collection
Responsiveness	None Identified
Flexibility	None Identified
Cost	Data maintenance costs
Assets	Empty-to-loaded backhaul mile index Equipment utilization rates (hours) Equipment utilization rates (product contribution margin) Vehicle maintenance costs
Best Practices	**Features**
Integrated Order Management, Warehouse Management and Transportation Management Systems View for analysis for all orders and shipments the following data: Logistics, Product, Cost, GL Charging Appointment Scheduling for Pickup and Delivery of Customer Shipments Measurement of Carrier Performance for On-time Delivery and Completeness Real-time Optimized Shipment Method Selection (Air Parcel, Ground Parcel, LTL, etc.) Based on Customer Service Requirements Real-time Shipment Tracking, (via Internet) Electronic Manifest and Electronic Billing Automated Documentation for International Shipments Manage Information across 100% of shipments Capture and maintain mode specific data	Transportation Management System (TMS) Maintenance Management
Internet Pooling (Electronic brokerage of shipments	Rating & Routing
Backhaul trading exchange	Pooling

Inputs	Plan	Source	Make	Deliver	Return
Air, Ground... Carrier Rate Tables					
Customer Service Requirements				ED.2	
Standard Practices/Rules	P				
Contract Carrier Rates		S			
Customer Order Size, Weight & Freight Class				D1.2, D2.2, D3.2	
Projected Delivery Requirements			M		

Outputs	Plan	Source	Make	Deliver	Return
Shipping Parameters & Documentation				D1.10, D2.9, D3.8	
Supply Chain Performance Metrics	P			ED.1	

Enable Process: Manage Product Life Cycle	Process Number: ED.7
Enable Process Definition	
The process of defining and maintaining the distribution channel/ network for a specific product line (no capital asset or transportation management).	
Performance Attributes	**Metric**
Reliability	Total distribution cost as a % of revenue Frequency of analysis (monthly, annual, 5 year planning cycle)
Responsiveness	None Identified
Flexibility	None Identified
Cost	None identified
Assets	Distribution capital cost
Best Practices	**Features**
Integrated Facility Management	None Identified
Operations and Network Analysis	None Identified
Standard Operating Procedures and Methodology	None Identified

Inputs	Plan	Source	Make	Deliver	Return
Product Mix and Plans, Revised Business Assumptions, Budgets, Source of Products	P				
Location of Customers				D1.2, D2.2, D3.2	

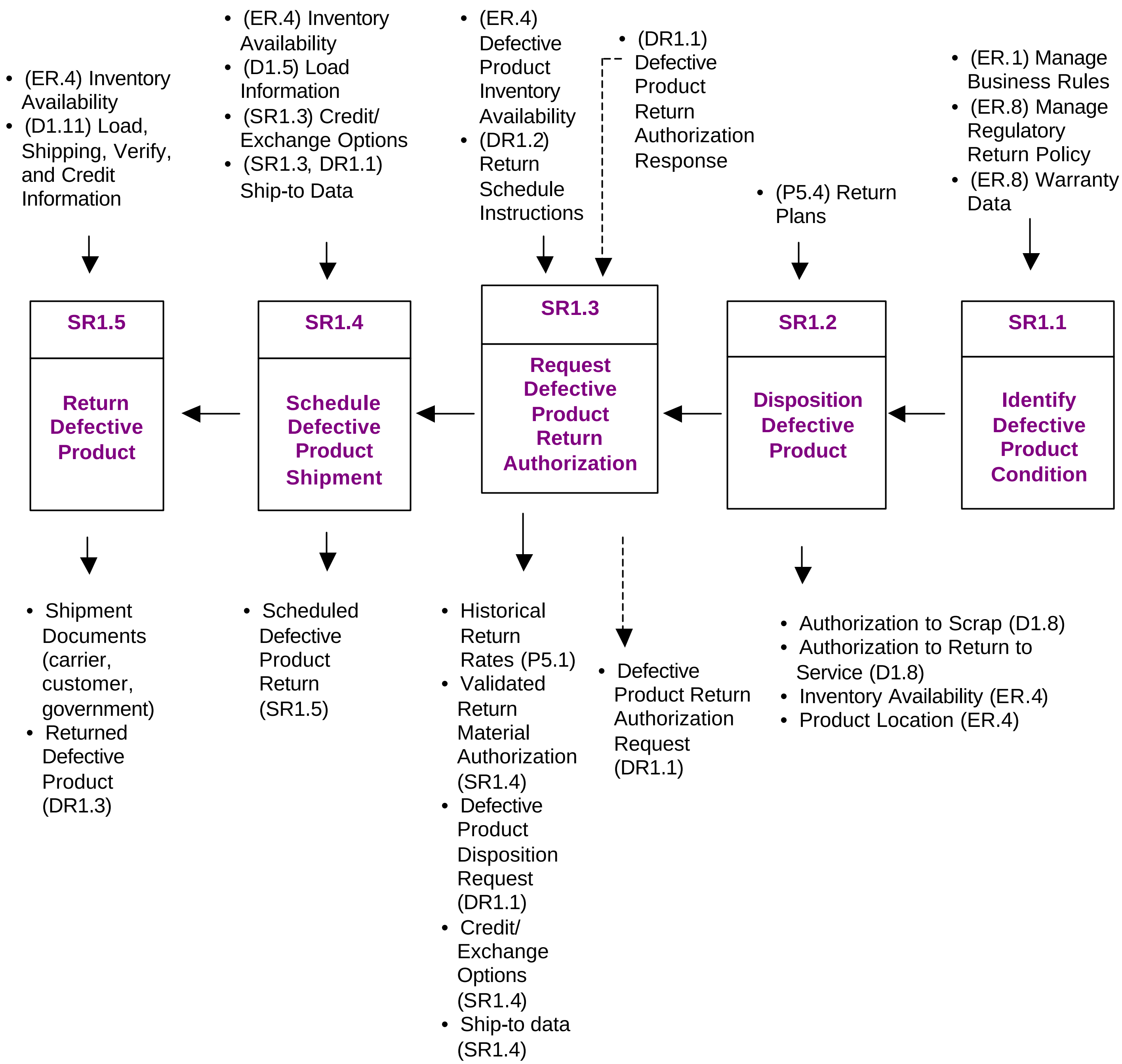
Outputs	Plan	Source	Make	Deliver	Return
Enterprise Distribution Model	P				

Enable Process: Manage Export/Import Requirements	Process Number: ED.8
Enable Process Definition	
The process of recording and maintaining regulations and rates, which constrain the ordering and delivering of product.	
Performance Attributes	**Metric**
Reliability	Compliance with multi-country government regulations Minimized delays in-transit caused by customs intervention
Responsiveness	None Identified
Flexibility	None Identified
Cost	Duty tax control Cost of compliance
Assets	None Identified
Best Practices	**Features**
	Multi-country Export/Import documentation compliance
Documents generated automatically during shipment preparation. Direct connection to customs clearance Direct Transfer of documents to Recipient and Forwarder	Electronic documentation submission via EDI and/or Internet
Assessing export/import requirements during time of product development/manufacture	None Identified
Ability to track component/sub-component manufacturing country of origin	Component/lot tracking (lot trace-ability)

Inputs	Plan	Source	Make	Deliver	Return
Government Regulations					
Shipping History				D1.10, D2.9, D3.8	
Receipt History		S1.2, S2.2, S3.4			
Tariffs & Duties					

Outputs	Plan	Source	Make	Deliver	Return
Shipping Export Parameters & Documentation				D1.10, D2.9, D3.8	
Government Constraints	P			ED.7	
Duty Drawback Claims					

SR1: Source Return Defective Product



Process Category: Source Return Defective Product	Process Number: SR1
Process Category Definition	
The process, initiated by the customer, of returning material deemed defective by to the last known holder or designated return center. Process includes: customer identification that an action is required and determining what that action should be, communicating with the last known holder, generating return documentation, and physically returning of the excess product.	
Performance Attributes	**Metric**
Reliability	% of defective product returns delivered complete to the last known holder or designated return center (correct destination, according to the schedule, with the correct part and documentation)
Responsiveness	Source Return Defective Product Cycle Time
Flexibility	Upside Source Return Flexibility Upside Source Return Adaptability
Costs	Total Source Return Defective Product Costs as % of (M+D) costs
Assets	Value of defective inventory/ total inventory value Return on Supply Chain Fixed Assets
Best Practices	**Features**
None Identified	None Identified

Process Element: Identify Defective Product Condition	Process Number: SR1.1
Process Category Definition	
The process where the customer utilizes planned policies, business rules and product operating conditions inspection as criteria to identify and confirm that material is excess to requirements defective.	
Performance Attributes	**Metric**
Reliability	None Identified
Responsiveness	Identify Defective Product Condition Cycle Time
Flexibility	None Identified
Costs	Cost of identifying the defective condition as a % of total Source cost
Assets	Value of defective inventory in identification stage/ total inventory value
Best Practices	**Features**
Enterprise level policies/rules with local execution.	Web based access to enterprise level business rules.

Inputs	Plan	Source	Make	Deliver	Return
Manage Business Rules					ER.1
Manage Regulatory Return Policy					ER.8
Warranty Data					ER.8

Outputs	Plan	Source	Make	Deliver	Return

Process Element: Disposition Defective Product	Process Number: SR1.2
Process Category Definition	
The process of the customer determining whether to return the defective item and the appropriate source contact for a return authorization.	
Performance Attributes	**Metric**
Reliability	None Identified
Responsiveness	Disposition Defective Product Cycle Time
Flexibility	None Identified
Costs	Defective product disposition costs as % total Source cost
Assets	Value of defective inventory in disposition stage/ total inventory value (inventory awaiting return)
Best Practices	**Features**
Drive returns directly to return stock point of disposition to reduce cost and cycle time.	Specify return disposition location and time.
Confirm asset return condition codes are clearly understood by all employees, especially those who are new to the process	None Identified
Confirm changes in condition code policies are promptly communicated to all employees and supply chain partners.	None Identified

Inputs	Plan	Source	Make	Deliver	Return
Return Plans	P5.4				

Outputs	Plan	Source	Make	Deliver	Return
Authorization to Scrap				D1.8	
Authorization to Return to Service				D1.8	
Inventory Availability					ER.4
Product Location					ER.4

Process Element: Request Defective Return Authorization	Process Number: SR1.3
Process Category Definition	
The process of a customer requesting and obtaining authorization, from last known holder or designated return center, for the return of defective product. Additionally, the customer and last known holder or designated return center would discuss enabling conditions such as return replacement or credit, packaging, handling, transportation and import / export requirements to facilitate the efficient return of the defective product.	
Performance Attributes	**Metric**
Reliability	% Authorization requests transmitted error-free / Total authorizations requested.
Responsiveness	Request Defective Return Authorization Cycle Time
Flexibility	None Identified
Costs	Return Authorization Cost per Request Authorization Return Authorization cost as % of Source cost
Assets	Value of defective product inventory in request return authorization stage/ total defective product inventory value (inventory awaiting return authorization)
Best Practices	**Features**
Long-term return agreements / partnerships to include the following information:	None Identified
Clarify point of contact and return location	Electronic rules for business relationships and transactions
Develop and clarify mutually understood cycle times to process return authorizations	Clarification as to who will pay in-bound and out-bound freight cost
Enable customer-service representatives to complete the bill of lading for the customer including carrier routing, weight, description and class to minimize guesswork & wrong estimates	Clarification of policy if authorizations are not processed within the expected cycle time

Inputs	Plan	Source	Make	Deliver	Return
Inventory Availability					ER.4
Defective Product Return Authorization Response					DR1.1
Return Schedule Instructions					DR1.2

Outputs	Plan	Source	Make	Deliver	Return
Historical Return Rates	P5.1				
Validated Return Material Authorization					SR1.4
Defective Product Disposition Request					DR1.1
Defective Product Return Authorization Request					DR1.1
Credit/ Exchange Options					SR1.4
Ship-to data					SR1.4

Process Element: Schedule Defective Shipment	Process Number: SR1.4
Process Category Definition	
The process where the customer develops the schedule for a carrier to pick-up for delivery of the defective product. Activities include selecting the carrier and rates, preparing the item for transfer, preparing scheduling documentation and managing overall scheduling administration.	
Performance Attributes	**Metric**
Reliability	% Shipping schedules that support customer required return by date
Responsiveness	Schedule Defective Shipment Cycle Time
Flexibility	None Identified
Costs	Defective product scheduling cost as % of Source cost Defective product scheduling cost / defective item
Assets	Value of defective product inventory in scheduling stage/ total defective product inventory value
Best Practices	**Features**
Consolidation of carriers	Outbound logistics software to assist with Route
Carrier selection based on performance criteria at least cost	Scheduling, carrier selection, and rating
Transportation Modeling and Rate Analysis	None Identified

Inputs	Plan	Source	Make	Deliver	Return
Inventory Availability					ER.4
Plan and Build Loads Information				D1.5	
Credit/ Exchange Options					SR1.3
Ship-to Data					SR1.3, DR1.1

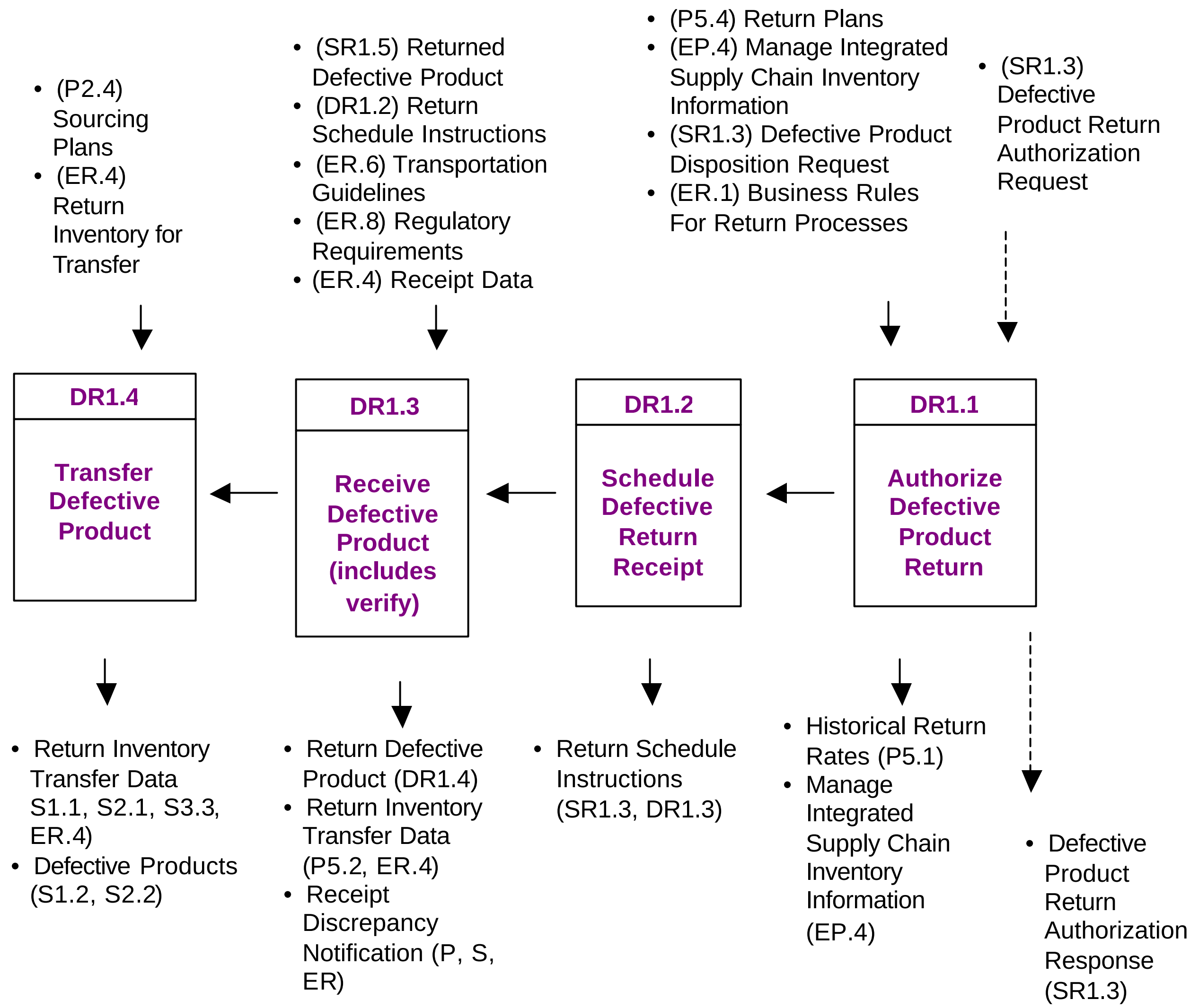
Outputs	Plan	Source	Make	Deliver	Return
Scheduled Defective Product Return					SR1.5

Process Element: Return Defective Product	Process Number: SR1.5
Process Category Definition	
The process where the customer packages, and handles the defective product in preparation for shipping in accord with pre-determined conditions. The product is then provided by the customer to the carrier who physically transports the product and its associated documentation to the last known holder or designated return center.	
Performance Attributes	**Metric**
Reliability	% Error-free Returns shipped Return shipments shipped on time
Responsiveness	Return Defective Product Cycle Time
Flexibility	None Identified
Costs	Defective product handling Cost per request authorization Return Transportation Costs as % of Source costs
Assets	Value of defective product inventory in physical return and transportation stage/ total defective inventory value
Best Practices	**Features**
Shipment tracking and tracing	Satellite communications, GPS, RFID
Advanced shipping notice	Integrated data sharing with repair facility

Inputs	Plan	Source	Make	Deliver	Return
Inventory Availability					ER.4
Load, Shipping, Verify, and Credit Information				D1.10	

Outputs	Plan	Source	Make	Deliver	Return
Shipment Documents (carrier, customer, government)					
Returned Defective Product					DR1.3

DR1: Deliver Return Defective Product



Process Category: Deliver Return Defective Product	Process Number: DR1
Process Category Definition	
The processes of the last known holder or designated return center authorizing and scheduling the defective product return and the physical receipt of the item by the last known holder or known return center and their transfer of the item for final disposition determination. The process includes communication between the customer and last known holder or known return center and the generation of associated documentation.	
Performance Attributes	**Metric**
Reliability	% Defective product returns delivered complete to the last known holder or designated return center (correct destination, according to the schedule, with the correct part and documentation)
Responsiveness	Deliver Return Defective Product Cycle Time
Flexibility	Upside Deliver Return Flexibility Upside Deliver Return Adaptability
Costs	Deliver Return costs as % of (M+D) costs
Assets	Value of defective product inventory in Deliver Return Process/ total defective product inventory value Return on Supply Chain Fixed Assets
Best Practices	**Features**
None Identified	None Identified

Process Element: Authorize Defective Product Return	Process Number: DR1.1
Process Category Definition	
The process where the last known holder or designated return center receives a defective product return authorization request from a customer, determines if the item can be accepted and communicates decision to the customer. Accepting the request would include negotiating the conditions of the return with the customer, including authorizing return replacement or credit. Rejecting the request would include providing a reason for the rejection to the customer.	
Performance Attributes	**Metric**
Reliability	None Identified
Responsiveness	Authorize Defective Product Return Cycle Time
Flexibility	None Identified
Costs	Return Authorization Cost per request authorization Ratio of authorization cost to total Deliver costs
Assets	Value of defective product inventory in authorization stage/ total defective product inventory value
Best Practices	**Features**
Set up electronic or pre-authorized returns	None Identified
Communicate with customer before the return to establish what types of returns are acceptable	None Identified
Use an exchange system where customer is issued a serviceable item upon submitting an unserviceable item.	None Identified

Inputs	Plan	Source	Make	Deliver	Return
Return Plans	P5.4				
Manage Iintegrated Supply Chain Inventory Information	EP.4				
Defective Product Return Authorization Request					SR1.3
Defective Product Disposition Request					SR1.3
Business Rules For Return Processes					ER.1

Outputs	Plan	Source	Make	Deliver	Return
Historical Return Rates	P5.1				
Manage Integrated Supply Chain Inventory Information	EP.4				
Defective Product Return Authorization Response					SR1.3

Process Element: Schedule Defective Return Receipt	Process Number: DR1.2
Process Category Definition	
The process where the last known holder or designated return center evaluates the defective product handling requirements including negotiated conditions and develops a schedule that tells the Customer when to ship the product. The scheduling activity would also inform Receiving when to expect the shipment and where to send the product, for disposition, upon receipt.	
Performance Attributes	**Metric**
Reliability	% Return schedules that are generated within supplier's lead time
Responsiveness	Schedule Defective Return Receipt Cycle Time
Flexibility	None Identified
Costs	Defective Product Return Scheduling costs as % of Deliver Return Costs
Assets	Value of defective product inventory in scheduling stage/ total defective product inventory value
Best Practices	**Features**
Integrate return planning with maintenance and inventory planning to optimize the system	Both customer and Service Provider departments are alerted at the same time and viewing the same information

Inputs	Plan	Source	Make	Deliver	Return

Outputs	Plan	Source	Make	Deliver	Return
Return Schedule Instructions					SR1.3, DR1.3

Process Element: Receive Defective Product	Process Number: DR1.3
Process Category Definition	
The process where the last known holder or designated return center receives and verifies the returned defective product against the return authorization and other documentation and prepares the item for transfer.	
Performance Attributes	**Metric**
Reliability	% Orders/ lines received damage free % Orders/ lines received complete % Orders/ lines received with on-time scheduled receipts % Orders/ lines received with correct shipping documents
Responsiveness	Receive Defective Product Cycle Time
Flexibility	None Identified
Costs	Receiving of Defective Product costs as a % of Deliver Return defective product Costs
Assets	Value of defective products inventory in receiving stage/ total defective product inventory value
Best Practices	**Features**
Bar coding is used to minimize handling time and maximize data accuracy	Product serial number used as identifier
Pre-certify supplier capability to send return products correctly to minimize the need for receipt verification	Push inspection to SOURCE Receiving quality criteria connected to ISO 9000 practices
Receivers on the dock communicate directly with the Buyer to efficiently resolve any discrepancies	Buyer's name for every receipt is clearly visible on Receiver
Develop local Receiving process close to repair	Minimize time spent in product movement
Customer sends Receiving advanced shipment notification prior to shipment	Electronically link Return authorization, Return schedule and shipping documents
Electronically track shipment from Customer to Service Provider	

Inputs	Plan	Source	Make	Deliver	Return
Returned Defective Product					SR1.5
Return Schedule Instructions					DR1.2
Transportation Guidelines					ER.6
Regulatory Requirements					ER.8
Receipt Data					ER.4

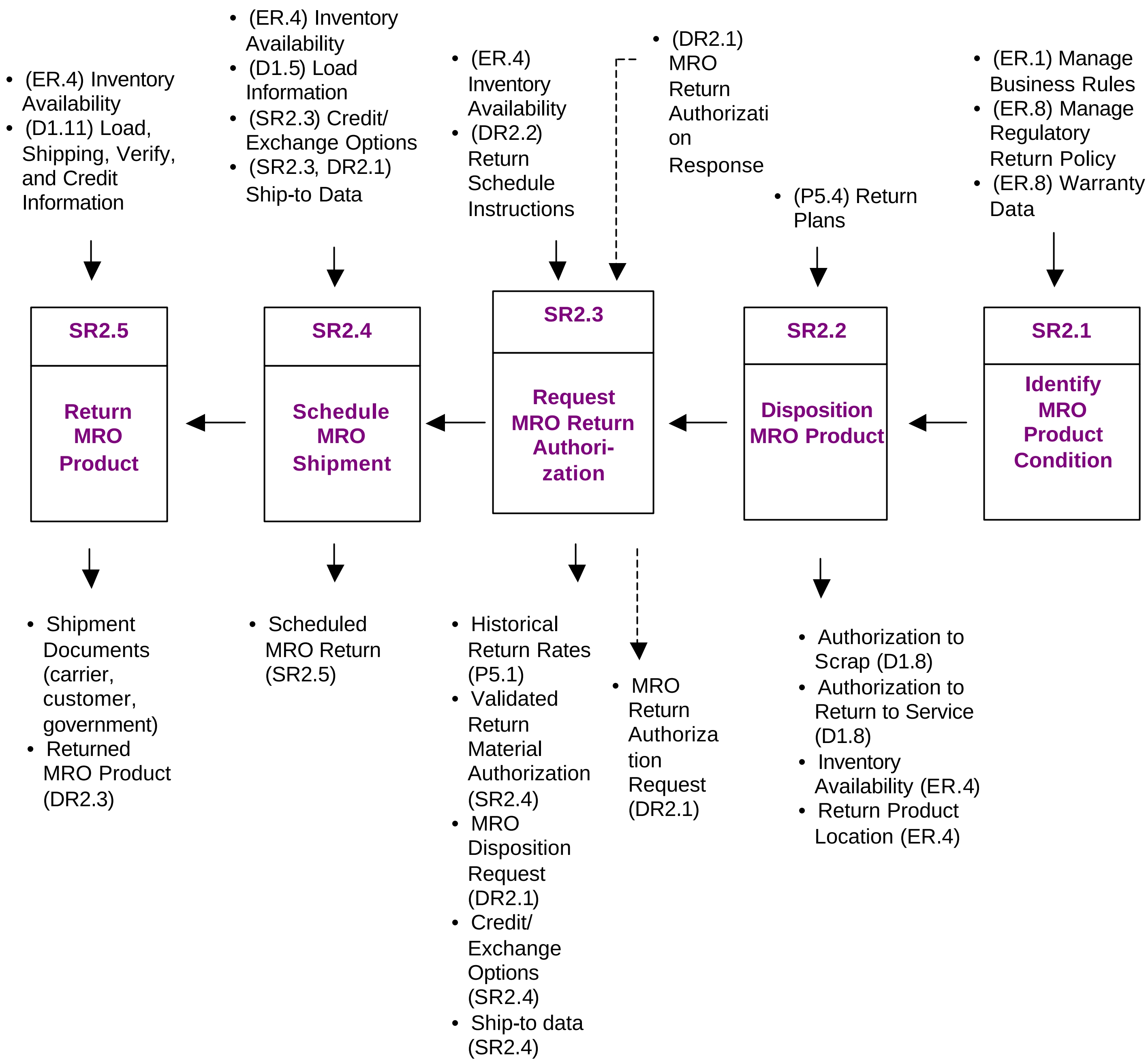
Outputs	Plan	Source	Make	Deliver	Return
Return Defective Product					DR1.4
Return Inventory Transfer Data	P5.2				ER.4
Receipt Discrepancy Notification	P	S			ER

Process Element: Transfer Defective Product	Process Number: DR1.4
Process Category Definition	
The process where the last known holder or designated return center transfers the defective product to the appropriate process to implement the disposition decision.	
Performance Attributes	**Metric**
Reliability	% Lost or damaged during transfer % Product transfer without transaction errors
Responsiveness	Transfer Defective Product Cycle Time
Flexibility	None Identified
Costs	Transfer and product storage costs as % of Deliver Return costs
Assets	Value of defective product inventory in transfer to storage stage/ total defective product inventory value
Best Practices	**Features**
Defective Products Scheduling identifies next destination (Source, Make, or Deliver) on Return authorization	Utilize electronic links
Return process electronically tracks transfer from station to station	Utilize Bar coding
Receiving equipment and packaging materials to transfer product are planned for in advance and readily available when needed	Include packaging materials in inventory management system and treat as any other inventory to minimize potential of stock-out
Review transfer cycle time trends and determine if equipment capacity is properly balanced with projected usage	Periodic review of capital asset plan to determine if additional equipment, if needed, can be funded.

Inputs	Plan	Source	Make	Deliver	Return
Sourcing Plans	P2.4				
Return Inventory Transfer Data					ER.4

Outputs	Plan	Source	Make	Deliver	Return
Return Inventory Transfer Data		S1.1, S2.1, S3.3			ER.4
Defective Products		S1.2, S2.2			

SR2: Source Return MRO Product



Process Category: Source Return MRO Product	Process Number: SR2
Process Category Definition	
The process, initiated by the customer, of returning maintenance, repair, and overhaul items to a service provider. Process includes: customer identification that an action is required and determining what that action should be, communicating with the service provider, generating return documentation, and physically returning or disposing of the product.	
Performance Attributes	**Metric**
Reliability	% MRO source returns returned to the correct customer location, within schedule, with the correct part and documentation
Responsiveness	Source Return MRO Product Cycle Time
Flexibility	Upside Source Return Flexibility Upside Source Return Adaptability
Costs	Total Source Return MRO Product Costs as % of (M+D) costs
Assets	Value of unserviceable MRO inventory/ total MRO inventory value Return on Supply Chain Fixed Assets
Best Practices	**Features**
None Identified	None Identified

Process Element: Identify MRO Product Condition	Process Number: SR2.1
Process Category Definition	
The process where the customer utilizes pre-determined MRO policies, business rules and product operating conditions as criteria to identify and confirm that an item requires maintenance, repair, overhaul or disposal. Includes operating failures and planned maintenance requirements.	
Performance Attributes	**Metric**
Reliability	Total number of confirmed MRO conditions / Total number of MRO service requests initiated
Responsiveness	Identify MRO Product Condition Cycle Time
Flexibility	None Identified
Costs	Cost of identifying the MRO condition as a % of total Source cost
Assets	Value of unserviceable MRO inventory in identification stage/ total MRO inventory value
Best Practices	**Features**
Enterprise level policies/rules with local execution.	Web based access to enterprise level business rules.

Inputs	Plan	Source	Make	Deliver	Return
Manage Business Rules					ER.1
Manage Regulatory Return Policy					ER.8
Warranty Data					ER.8

Outputs	Plan	Source	Make	Deliver	Return

Process Element: Disposition MRO Product	Process Number: SR2.2
Process Category Definition	
The process of the customer determining whether to service the item, what service is required, and who the appropriate service provider would be to service the item. Outputs include a decision to: (1) send a return authorization request to a service provider, (2) send the product back into service without requiring a return authorization request, or (3) discard the item.	
Performance Attributes	**Metric**
Reliability	% Identified MRO products returned to service
Responsiveness	Disposition MRO Product Cycle Time
Flexibility	None Identified
Costs	MRO disposition costs as % total Source cost
Assets	Value of unserviceable MRO inventory in disposition stage/ total MRO inventory value (inventory awaiting disposition)
Best Practices	**Features**
Drive returns directly to return stock point of disposition to reduce cost and cycle time.	Specify return disposition location and time.
Confirm asset return condition codes are clearly understood by all employees, especially those who are new to the process	None Identified
Confirm changes in condition code policies are promptly communicated to all employees and supply chain partners.	None Identified

Inputs	Plan	Source	Make	Deliver	Return
Return Plans	P5.4				

Outputs	Plan	Source	Make	Deliver	Return
Authorization to Scrap				D1.8	
Authorization to Return to Service				D1.8	
Inventory Availability					ER.4
Return Product Location					ER.4

Process Element: Request MRO Return Authorization	Process Number: SR2.3
Process Category Definition	
The process of a customer requesting and obtaining authorization, from a service provider, for the return of an MRO product. In addition to discussing the MRO issue, the customer and service provider would discuss enabling conditions such as return replacement or credit, packaging, handling, transportation and import / export requirements to facilitate the efficient return of the MRO product to the service provider. The customer may need to go through several return authorization iterations with multiple service providers before authorization is received.	
Performance Attributes	**Metric**
Reliability	% Authorization requests transmitted error-free / Total authorizations requested
Responsiveness	Request MRO Return Authorization Cycle Time
Flexibility	None Identified
Costs	Return Authorization Cost per Request Authorization Ratio of Authorization cost to total Source cost
Assets	Value of unserviceable MRO inventory in request return authorization stage/ total MRO inventory value (inventory awaiting return authorization)
Best Practices	**Features**
Long-term return agreements / partnerships to include the following information:	None Identified
Clarify point of contact and return location	Electronic rules for business relationships and transactions
Develop and clarify mutually understood cycle times to process return authorizations	Clarification as to who will pay in-bound and out-bound freight cost
Enable customer-service representatives to complete the bill of lading for the customer including carrier routing, weight, description and class to minimize guesswork & wrong estimates	Clarification of policy if authorizations are not processed within the expected cycle time

Inputs	Plan	Source	Make	Deliver	Return
Inventory Availability					ER.4
MRO Return Authorization Response					DR2.1
Return Schedule Instructions					DR2.2

Outputs	Plan	Source	Make	Deliver	Return
Historical Return Rates	P5.1				
Validated Return Material Authorization		SR2.4			
MRO Return Authorization Request					DR2.1
MRO Disposition Request					DR2.1
Credit/ Exchange Options					SR2.4
Ship-to data					SR2.4

Process Element: Schedule MRO Shipment	Process Number: SR2.4
Process Category Definition	
The process where the customer develops the schedule for a carrier to pick-up and deliver the MRO product. Activities include selecting the carrier and rates, preparing the item for transfer, preparing scheduling documentation and managing overall scheduling administration.	
Performance Attributes	**Metric**
Reliability	% Shipping schedules that support customer required return by date
Responsiveness	Schedule MRO Shipment Cycle Time
Flexibility	None Identified
Costs	MRO scheduling cost as % of Source cost MRO scheduling cost / defective item
Assets	Value of unserviceable MRO inventory in scheduling stage/ total MRO inventory value
Best Practices	**Features**
Consolidation of carriers	Outbound logistics software to assist with Route
Carrier selection based on performance criteria at least cost	Scheduling, carrier selection, and rating
Transportation Modeling and Rate Analysis	None Identified

Inputs	Plan	Source	Make	Deliver	Return
Inventory Availability					ER.4
Plan and Build Loads Information				D1.5	
Credit/ Exchange Options					SR2.3
Ship-to Data					SR2.3, DR2.1

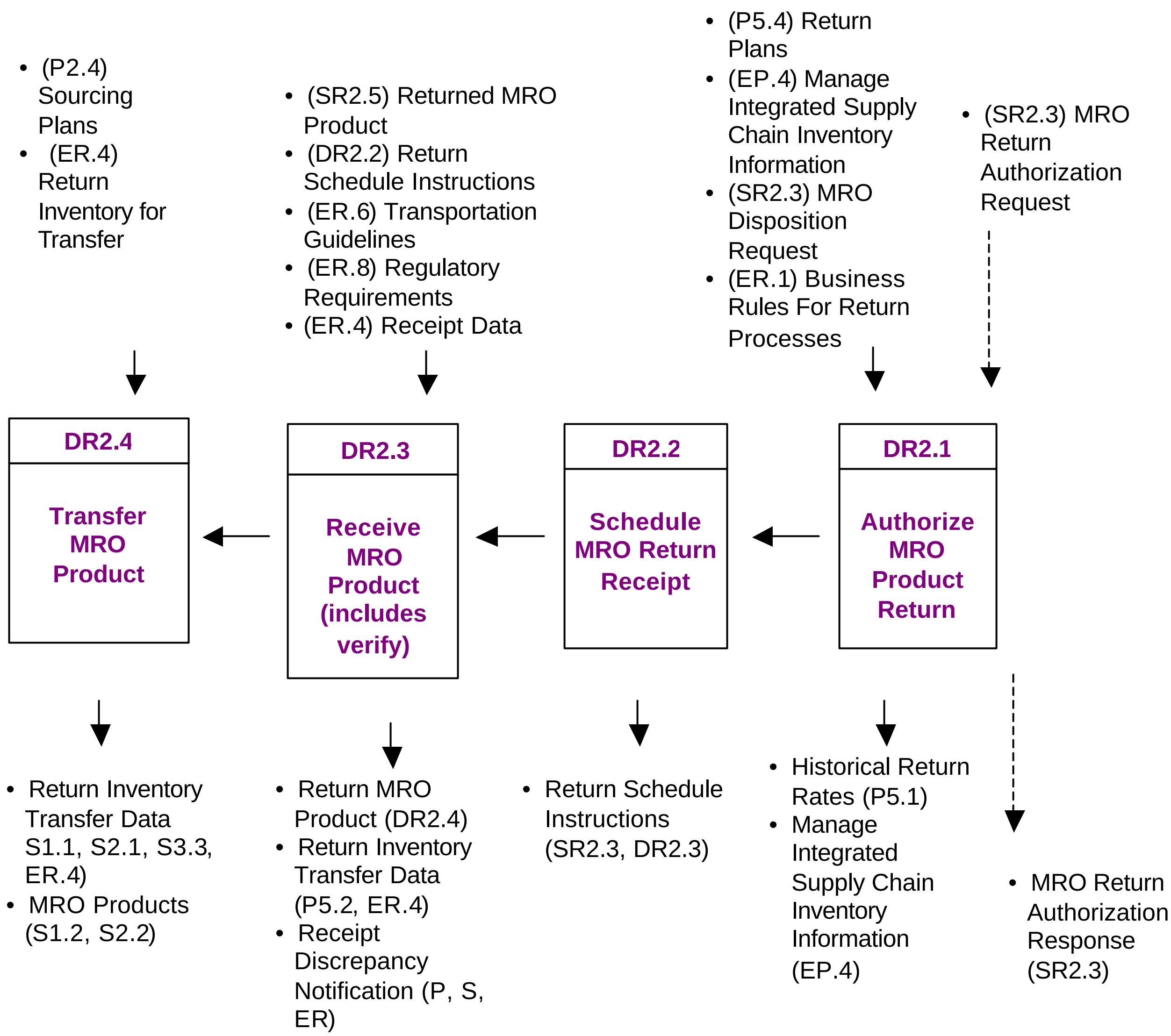
Outputs	Plan	Source	Make	Deliver	Return
Scheduled MRO Return					SR2.5

Process Element: Return MRO Product	Process Number: SR2.5
Process Category Definition	
The process where the customer packages, and handles the MRO product in preparation for shipping in accord with pre-determined conditions. The product is then provided by the customer to the carrier who physically transports the product and its associated documentation to the service provider.	
Performance Attributes	**Metric**
Reliability	% Error-free Returns shipped Return shipments shipped on time
Responsiveness	Return MRO Product Cycle Time
Flexibility	None Identified
Costs	MRO handling Cost per request authorization Return Transportation Costs as % of Source costs
Assets	Value of unserviceable MRO inventory in physical return and transportation stage/ total MRO inventory value
Best Practices	**Features**
Shipment tracking and tracing	Satellite communications, GPS, RFID
Advanced shipping notice	Integrated data sharing with repair facility

Inputs	Plan	Source	Make	Deliver	Return
Inventory Availability					ER.4
Load, Shipping, Verify, and Credit Information				D1.10	

Outputs	Plan	Source	Make	Deliver	Return
Shipment Documents (carrier, customer, government)					
Returned MRO Product					DR2.3

DR2: Deliver Return MRO Product



Process Category: Deliver Return MRO Product	Process Number: DR2
Process Category Definition	
The processes of the service provider authorizing and scheduling the MRO return product and the physical receipt of the item by the service provider and their transfer of the item for final disposition determination. The process includes communication between the customer and service provider and the generation of associated documentation.	
Performance Attributes	**Metric**
Reliability	% MRO returns delivered to the correct service provider location, within schedule, with the correct part and documentation
Responsiveness	Deliver Return MRO Product Cycle Time
Flexibility	Upside Deliver Return Flexibility Upside Deliver Return Adaptability
Costs	Deliver Return MRO costs as % of (M+D) costs
Assets	Value of unserviceable MRO inventory in Deliver Return Process/ total MRO inventory value Return on Supply Chain Fixed Assets
Best Practices	**Features**
None Identified	None Identified

Process Element: Authorize MRO Product Return	Process Number: DR2.1
Process Category Definition	
The process where a service provider receives an MRO product return authorization request from a customer, determines if the item can be accepted for MRO and communicates their decision to the customer. Accepting the request would include negotiating the conditions of the return with the customer, including authorizing return replacement or credit. Rejecting the request would include providing a reason for the rejection to the customer.	
Performance Attributes	**Metric**
Reliability	None Identified
Responsiveness	Authorize MRO Product Return Cycle Time
Flexibility	None Identified
Costs	Cost per request authorization Ratio of authorization cost to total deliver return costs
Assets	Value of unserviceable MRO inventory in authorization stage/ total MRO inventory value
Best Practices	**Features**
Set up electronic or pre-authorized returns	None Identified
Communicate with customer before the return to establish what types of returns are acceptable	None Identified
Use an exchange system where customer is issued a serviceable item upon submitting an unserviceable item.	None Identified

Inputs	Plan	Source	Make	Deliver	Return
Return Plans	P5.4				
Manage Integrated Supply Chain Inventory Information	EP.4				
MRO Return Authorization Request					SR2.3
MRO Disposition Request					SR2.3
Business Rules For Return Processes					ER.1

Outputs	Plan	Source	Make	Deliver	Return
Historical Return Rates	P5.1				
Manage Integrated Supply Chain Inventory Information	EP.4				
MRO Return Authorization Response					SR2.3

Process Element: Schedule MRO Return Receipt	Process Number: DR2.2
Process Category Definition	
The process where the service provider evaluates the MRO service requirements including negotiated conditions and develops a schedule that tells the Customer when to ship the part. The scheduling activity would also inform Receiving when to expect the shipment and where to send the part, for induction or storage, upon receipt.	
Performance Attributes	**Metric**
Reliability	% Return schedules that are generated within supplier's lead time
Responsiveness	Schedule MRO Return Receipt Time
Flexibility	None Identified
Costs	MRO Return Scheduling costs as % of Deliver Return Costs
Assets	Value of unserviceable MRO inventory in scheduling stage/ total MRO inventory value
Best Practices	**Features**
Integrate return planning with maintenance and inventory planning to optimize the system	Both customer and Service Provider departments are alerted at the same time and viewing the same information

Inputs	Plan	Source	Make	Deliver	Return

Outputs	Plan	Source	Make	Deliver	Return
Return Schedule Instructions					SR2.3, DR2.3

Process Element: Receive MRO Product	Process Number: DR2.3
Process Category Definition	
The process where the service provider receives and verifies the returned MRO item against the return authorization and other documentation and prepares the item for transfer.	
Performance Attributes	**Metric**
Reliability	% Orders/ lines received damage free % Orders/ lines received complete % Orders/ lines received with on-time scheduled receipts % Orders/ lines received with correct shipping documents
Responsiveness	Receive MRO Product Time
Flexibility	None Identified
Costs	Receiving costs as a % of MRO Costs Receiving of MRO Product costs as a % of Deliver Return MRO product Costs
Assets	Value of unserviceable MRO inventory in receiving stage/ total MRO inventory value
Best Practices	**Features**
Bar coding is used to minimize handling time and maximize data accuracy	Product serial number used as identifier
Pre-certify supplier capability to send return products correctly to minimize the need for receipt verification	Push inspection to SOURCE Receiving quality criteria connected to ISO 9000 practices
Receivers on the dock communicate directly with the Buyer to efficiently resolve any discrepancies	Buyer’s name for every receipt is clearly visible on Receiver
Develop local Receiving process close to repair	Minimize time spent in product movement
Customer sends Receiving advanced shipment notification prior to shipment	Electronically link Return authorization, Return schedule and shipping documents
Electronically track shipment from Customer to Service Provider	None Identified

Inputs	Plan	Source	Make	Deliver	Return
Returned MRO Product					SR2.5
Return Schedule Instructions					DR2.2
Transportation Guidelines					ER.6
Regulatory Requirements					ER.8
Receipt Data					ER.4

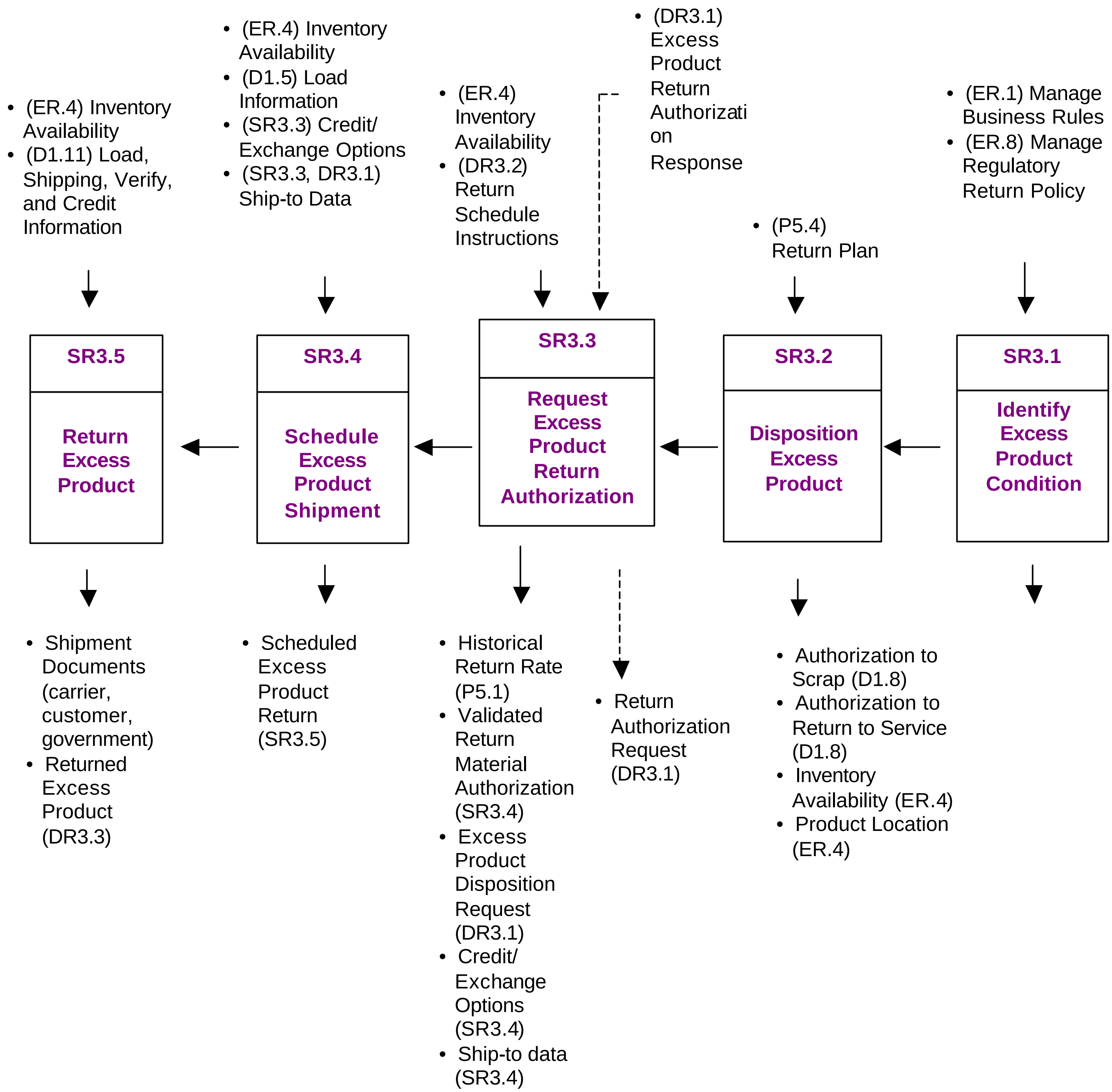
Outputs	Plan	Source	Make	Deliver	Return
Return MRO Product					DR2.4
Return Inventory Transfer Data	P5.2				ER.4
Receipt Discrepancy Notification	P	S			ER

Process Element: Transfer MRO Product	Process Number: DR2.4
Process Category Definition	
The process where the service provider transfers the MRO product to the appropriate process to implement the disposition decision.	
Performance Attributes	**Metric**
Reliability	% Lost or damaged during transfer % Product transfer without transaction errors
Responsiveness	Transfer MRO Product Cycle Time
Flexibility	None Identified
Costs	Transfer and MRO product storage costs as % of Deliver Return costs
Assets	Value of unserviceable MRO inventory in transfer to storage stage/ total MRO inventory value
Best Practices	**Features**
MRO Scheduling identifies next destination (Stores or Repair Station) on Return authorization	Utilize electronic links
Return process electronically tracks transfer from station to station	Utilize Bar coding
Receiving equipment and packaging materials to transfer product are planned for in advance and readily available when needed	Include packaging materials in inventory management system and treat as any other inventory to minimize potential of stock-out
Review transfer cycle time trends and determine if equipment capacity is properly balanced with projected usage	Periodic review of capital asset plan to determine if additional equipment, if needed, can be funded.

Inputs	Plan	Source	Make	Deliver	Return
Sourcing Plans	P2.4				
Return Inventory Transfer Data					ER.4

Outputs	Plan	Source	Make	Deliver	Return
Return Inventory Transfer Data		S1.1, S2.1, S3.3			ER.4
MRO Products		S1.2, S2.2			

SR3: Source Return Excess Product



Process Category: Source Return Excess Product	Process Number: SR3
Process Category Definition	
The process, initiated by the customer, of returning material deemed in excess of current requirements to the designated return center. Process includes: customer identification that an action is required, determining what that action should be, requesting authorization from the designated return center, generating return documentation, and physically returning the excess product.	
Performance Attributes	**Metric**
Reliability	% Excess product returns delivered complete to the designated return center (correct destination, according to the schedule, with the correct part and documentation)
Responsiveness	Source Return Excess Product Cycle Time
Flexibility	Upside Source Return Flexibility Upside Source Return Adaptability
Costs	Total Source Return Excess Product Costs as % of (M+D) costs
Assets	Value of excess inventory/ total inventory value Average age of Excess Inventory Return on Supply Chain Fixed Assets
Best Practices	**Features**
None Identified	None Identified

Process Element: Identify Excess Product Condition	Process Number: SR3.1
Process Category Definition	
The process where the customer utilizes planned policies, business rules and product inspection as criteria to identify and confirm that material is in excess of the current requirements.	
Performance Attributes	**Metric**
Reliability	Number of occurrences where excess inventory is returned and subsequently followed by an expedite request
Responsiveness	Identify Excess Product Conditions Cycle Time
Flexibility	None Identified
Costs	Cost of identifying the excess condition as a % of total Source cost
Assets	Value of excess inventory in identification stage/ total inventory value
Best Practices	**Features**
Enterprise level policies/rules with local execution.	Web based access to enterprise level business rules.
Automated inventory visibility and planning system to highlight inventory in excess of requirements	Automated inventory planning package linked to real time demand data and inventory business rules.

Inputs	Plan	Source	Make	Deliver	Return
Manage Business Rules					ER.1
Manage Regulatory Return Policy					ER.8

Outputs	Plan	Source	Make	Deliver	Return
Disposition					

Process Element: Disposition Excess Product	Process Number: SR3.2
Process Category Definition	
The process of the customer determining whether to return the excess material and identification of a designated return center a return authorization.	
Performance Attributes	**Metric**
Reliability	Number of occurrences of incorrect designated return center
Responsiveness	Disposition Excess Product Cycle Time
Flexibility	None Identified
Costs	Excess product disposition costs as % total Source cost
Assets	Value of excess inventory in disposition stage/ total inventory value (inventory awaiting return)
Best Practices	**Features**
Drive returns directly to return stock point of disposition to reduce cost and cycle time.	Automated return disposition location and time.
Automated registry of inventory return locations by item to speed identification of proper return location.	None Identified

Inputs	Plan	Source	Make	Deliver	Return
Return Plans	P5.4				

Outputs	Plan	Source	Make	Deliver	Return
Authorization to Scrap				D1.8	
Authorization to Return to Service				D1.8	
Inventory Availability					ER.4
Return Product Location					ER.4

Process Element: Request Excess Return Authorization	Process Number: SR3.3
Process Category Definition	
The process of a customer requesting and obtaining authorization, from the designated return center, for the return of excess product. Additionally, the customer and designated return center would negotiate enabling conditions such as return credit or cash discount, packaging, handling, transportation and import / export requirements to facilitate the efficient return of the excess product.	
Performance Attributes	**Metric**
Reliability	% Authorization requests transmitted error-free / Total authorizations requested
Responsiveness	Request Excess Return Authorization Cycle Time
Flexibility	None Identified
Costs	Return Authorization Cost per Request Authorization Ratio of Authorization cost as % of Source cost
Assets	Value of excess product inventory in request return authorization stage/ total excess product inventory value (inventory awaiting return authorization)
Best Practices	**Features**
Long-term return agreements / partnerships	Enables predictability and consistency in the return process
Clarify point of contact and return location	Electronic rules for business relationships and transactions
Develop and clarify mutually understood cycle times to process return authorizations	Clarification as to who will pay in-bound freight cost
Enable customer-service representatives to complete the bill of lading for the customer including carrier routing, weight, description and class to minimize guesswork & wrong estimates	Clarification of policy if authorizations are not processed within the expected cycle time

Inputs	Plan	Source	Make	Deliver	Return
Excess Product Return Authorization Request					DR3.1
Return Schedule Instructions					DR3.2
Inventory Availability					ER.4

Outputs	Plan	Source	Make	Deliver	Return
Excess Product Return Authorization Request					DR3.1
Validated Return Material Authorization					SR3.4
Excess Product Disposition Request					DR3.1
Credit/ Exchange Options					SR3.4
Ship-to data					SR3.4

Process Element: Schedule Excess Shipment	Process Number: SR3.4
Process Category Definition	
The process where the customer develops the schedule for a carrier to pick-up the excess product. Activities include selecting the carrier and rates, preparing the item for transfer, preparing scheduling documentation and managing overall scheduling administration.	
Performance Attributes	**Metric**
Reliability	% Shipping schedules that support customer required return by date
Responsiveness	Schedule Excess Shipment Cycle Time
Flexibility	None Identified
Costs	Excess product scheduling cost as % of Source cost Excess product scheduling cost / Excess item
Assets	Value of excess product inventory in scheduling stage/ total excess product inventory value
Best Practices	**Features**
Consolidation of carriers	In-bound logistics software to assist with Route
Carrier selection based on performance criteria at least cost	Scheduling, carrier selection, and rating
Transportation Modeling and Rate Analysis	Scheduling takes into account the sporadic and random nature of excess material returns
Arrange for shipping insurance in case of in-transit loss or damage	Preventative management

Inputs	Plan	Source	Make	Deliver	Return
Inventory Availability					ER.4
Plan and Build Loads Information				D1.5	
Credit/ Exchange Options					SR3.3
Ship-to Data					SR3.3, DR3.1

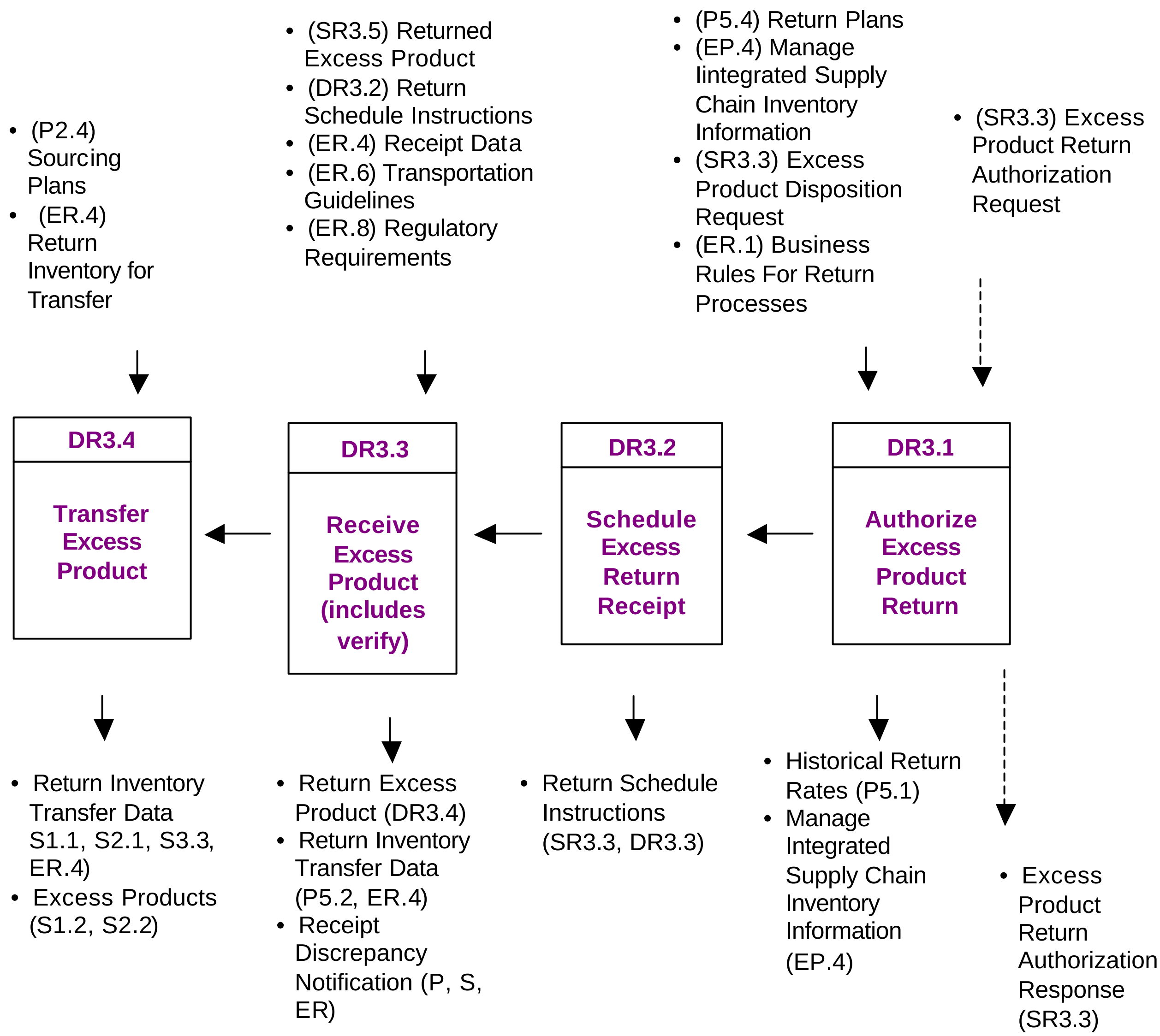
Outputs	Plan	Source	Make	Deliver	Return
Scheduled Excess Product Return					SR3.5

Process Element: Return Excess Product	Process Number: SR3.5
Process Category Definition	
The process where the customer packages, and handles the excess product in preparation for shipping in accord with pre-determined conditions. The product is then provided by the customer to the carrier who physically transports the product and its associated documentation to the last known holder or designated return center.	
Performance Attributes	**Metric**
Reliability	% Error-free Returns shipped Return shipments shipped on time
Responsiveness	Return Excess Product Cycle Time
Flexibility	None Identified
Costs	Excess product handling Cost per request authorization Return Transportation Costs as % of Source costs
Assets	Value of excess product inventory in physical return and transportation stage/ total excess inventory value
Best Practices	**Features**
Shipment tracking and tracing	Satellite communications, GPS, RFID
Advanced shipping notice	Integrated data sharing with repair facility

Inputs	Plan	Source	Make	Deliver	Return
Inventory Availability					ER.4
Load, Shipping, Verify, and Credit Information				D1.10	
Shipping schedule					SR3.4

Outputs	Plan	Source	Make	Deliver	Return
Shipment Documents (carrier, customer, government)					
Returned Excess material					SR3.5

DR3: Deliver Return Excess Product



Process Category: Deliver Return Excess Product	Process Number: DR3
Process Category Definition	
The processes of the designated return center authorizing and scheduling the excess product return, the physical receipt of the item by the designated return center and transfer of the item for final disposition The process includes communication between the customer and designated return center and the generation of associated documentation.	
Performance Attributes	**Metric**
Reliability	% Excess product returns delivered complete to the last known holder or designated return center (correct destination, according to the schedule, with the correct part and documentation)
Responsiveness	Deliver Return Excess Product Cycle Time
Flexibility	Upside Deliver Return Flexibility Upside Deliver Return Adaptability
Costs	Deliver Return Excess Product costs as % of (M+D) costs
Assets	Value of excess product inventory in Deliver Return Process/ total excess product inventory value Return on Supply Chain Fixed Assets
Best Practices	**Features**
None Identified	None Identified

Process Element: Authorize Excess Product Return	Process Number: DR3.1
Process Category Definition	
The process where the designated return center receives an excess product return authorization request from a customer, determines if the item can be accepted and communicates their decision to the customer. Accepting the request would include negotiating the conditions of the return with the customer, including authorizing credit or cash discount. Rejecting the request would include providing a reason for the rejection to the customer.	
Performance Attributes	**Metric**
Reliability	Number of occurrences where an authorized return was subsequently cancelled
Responsiveness	Authorize Excess Product Cycle Time
Flexibility	None Identified
Costs	Excess Product Return Authorization Cost per request authorization Ratio of Excess Product Return authorization cost to total Deliver \ costs
Assets	Value of excess product inventory in authorization stage/ total excess product inventory value
Best Practices	**Features**
Set up electronic or pre-authorized returns	Consistency of process and minimized data input
Communicate with customer before the return to establish what types of returns are acceptable	Pre-determined allowable material conditions and elapsed time rules

Inputs	Plan	Source	Make	Deliver	Return
Return Plans	P5.4				
Manage Integrated Supply Chain Inventory Information	EP.4				
Excess Product Return Authorization Request					SR3.3
Excess Product Disposition Request					SR3.3
Business Rules For Return Processes					ER.1

Outputs	Plan	Source	Make	Deliver	Return
Historical Return Rates	P5.1				
Manage Integrated Supply Chain Inventory Information	EP.4				
Authorized or Unauthorized Excess Material Response					SR3.3

Process Element: Schedule Excess Return Receipt	Process Number: DR3.2
Process Category Definition	
The process where the l designated return center evaluates an authorized excess material return to determine packaging and handling requirements. This assessment will lead to the development of a return disposition decision and a return schedule with terms and conditions that will tell the Customer how and when to ship the product. The scheduling activity would also inform the Return Center's Receiving department when to expect the shipment and where to send the product, for disposition, upon receipt.	
Performance Attributes	**Metric**
Reliability	% Return schedules that are generated within supplier's lead time
Responsiveness	Schedule Excess Return Receipt Cycle Time
Flexibility	None Identified
Costs	Excess Product Return Scheduling costs as % of Deliver Return Costs
Assets	Value of excess product inventory in scheduling stage/ total excess product inventory value
Best Practices	**Features**
Establish designated processes for scheduling and receiving excess inventory	None Identified

Inputs	Plan	Source	Make	Deliver	Return

Outputs	Plan	Source	Make	Deliver	Return
Return Schedule Instructions					SR3.3, DR3.3

Process Element: Receive Excess Product	Process Number: DR3.3
Process Category Definition	
The process where the designated return center receives and verifies the returned excess product and associated documentation against the return authorization and other documentation and prepares the item for transfer. Administrate any discrepancies that arise.	
Performance Attributes	**Metric**
Reliability	% Orders/ lines received damage free % Orders/ lines received complete % Orders/ lines received with on-time scheduled receipts % Orders/ lines received with correct shipping documents
Responsiveness	Receive Excess Product Cycle Time
Flexibility	None Identified
Costs	Receiving of Excess Product costs as a % of Deliver Return Excess product Costs
Assets	Value of excess products inventory in receiving stage/ total excess product inventory value
Best Practices	**Features**
Bar coding is used to minimize handling time and maximize data accuracy	Product serial number used as identifier
Pre-certify supplier capability to send return products correctly to minimize the need for receipt verification	Push inspection to SOURCE Receiving quality criteria connected to ISO 9000 practices
Receivers on the dock communicate directly with the Buyer to efficiently resolve any discrepancies	Buyer's name for every receipt is clearly visible on Receiver
Develop local Receiving process close to repair	Minimize time spent in product movement
Customer sends Receiving advanced shipment notification prior to shipment	Electronically link Return authorization, Return schedule and shipping documents
Electronically track shipment from Customer to Service Provider	

Inputs	Plan	Source	Make	Deliver	Return
Returned Excess Product					SR3.5
Return Schedule Instructions					DR3.2
Receipt Data					ER.4
Transportation Guidelines					ER.6
Regulatory Requirements					ER.8

Outputs	Plan	Source	Make	Deliver	Return
Return Excess Product					DR3.4
Return Inventory Transfer Data	P5.2				ER.4
Resolved Discrepancy Notification	P	S			ER

Process Element: Transfer Excess Product	Process Number: DR3.4
Process Category Definition	
The process where the designated return center transfers the excess product to the appropriate process to implement the disposition decision.	
Performance Attributes	**Metric**
Reliability	% Lost or damaged during transfer % Product transfer without transaction errors
Responsiveness	Transfer Excess Product Cycle Time
Flexibility	None Identified
Costs	Receiving of Excess Product costs as a % of Deliver Return Excess product Costs
Assets	Value of excess product inventory in transfer to storage stage/ total excess product inventory value
Best Practices	**Features**
Excess Products Scheduling identifies next destination (Source, Make, or Deliver) on Return authorization	Utilize electronic links
Return process electronically tracks transfer from station to station	Utilize Bar coding
Receiving equipment and packaging materials to transfer product are planned for in advance and readily available when needed	Include packaging materials in inventory management system and treat as any other inventory to minimize potential of stock-out
Review transfer cycle time trends and determine if equipment capacity is properly balanced with projected usage	Periodic review of capital asset plan to determine if additional equipment, if needed, can be funded.

Inputs	Plan	Source	Make	Deliver	Return
Sourcing Plans	P2.4				
Return Inventory Transfer Data					ER.4

Outputs	Plan	Source	Make	Deliver	Return
Return Inventory Transfer Data		S1.1, S2.1, S3.3			ER.4
Excess Products		S1.2, S2.2			

ER: Enable Return

- (P5.4) Process Procedures, Return Rules and Policies

ER.1

Manage Return Business Rules

- Manage Business Rules (SR1.1, SR2.1, SR3.1)
- Business Rules for Return Processes (P5.1, P5.2, DR1.1, DR2.1, DR3.1, ER.4, ER.5, ER.7)

- Return Benchmark Data
- (P5.4) Process Procedures
- (ER.3, ER.4) Receipt Data
- (ER.5) MRO Product Return Capabilities

ER.2

Assess Return Performance

- MRO Product Return Capabilities (P5.2)
- Return Product History (ER.3)
- Return Performance (ER.5, ER.6)

- (ER.2) Return Product History
- Data System Requirements, Data Cleansing Procedure

ER. 3

Maintain Return Data Collection

- Data and Return Capabilities (P5.2)
- Receipt Data (DR1.3, DR2.3, DR3.3, ER.2)

- (P5.4) Return Plans
- (SR1.2, SR2.2, SR3.2) Inventory Availability
- (SR1.2, SR2.2, SR3.2) Return Product Location
- (DR1.4, DR2.4, DR3.4) Return Inventory Transfer Data
- (ER.1) Business Rules for Return Processes

ER.4

Manage Return Inventory

- Return Inventory Targets (P5.2)
- Inventory Availability (SR1.3, SR1.4, SR1.5, SR2.3, SR2.4, SR2.5, SR3.3, SR3.4, SR3.5)
- Receipt Data (DR1.3, DR2.3, DR3.3, ER.2)
- Return Inventory for Transfer (DR1.4, DR2.4, DR3.4)

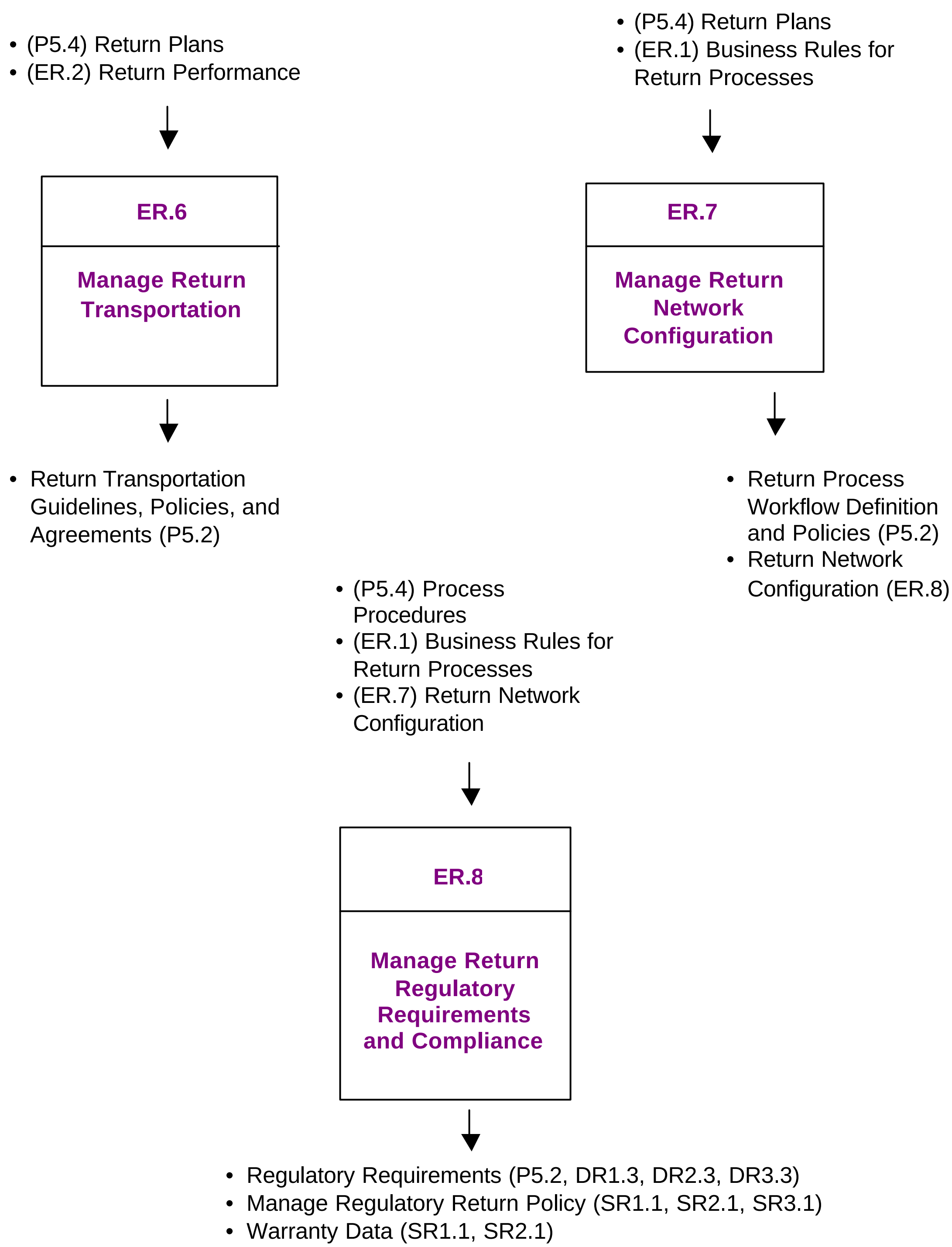
- (P5.4) Return Plans
- (ER.1) Business Rules for Return Processes
- (ER.2) Return Performance

ER.5

Manage Return Capital Assets

- MRO Product Return Capabilities (P5.2, ER.2)

ER: Enable Return



Enable Process: Manage Business Rules for Return Processes	Process Number: ER.1
Enable Process Definition	
The process of establishing, maintaining, and enforcing decision support criteria for Return Planning that are translated into rules for conducting business. These rules align Return process policies with business strategy, goals, and objectives. Examples of business rules include those that (1) Enable customers to identify when scheduled and unscheduled conditions occur that require a return authorization request, (2) Enable a service provider to confirm a part is authorized to be returned, (3) Identify the waiting period to confirm a return item has been shipped and received before following up (4) Develop and maintain customer and channel performance standards of return processes such as service levels, given service requirements by supply chain stakeholders/trading partners.(5) Communicate to customers the allowable amount of elapsed time from purchase and condition in which excess material must be received in order for it to be accepted as a return (6) Negotiate any restocking charge stipulations.	
Performance Attributes	**Metric**
Reliability	The degree & frequency of conformance to business rules that is achieved
Responsiveness	None Identified
Flexibility	None Identified
Costs	Cost of process documentation, monitoring and auditing business rules as % of (M+D). Return repair cost / return.
Assets	Return on assets based on business rules.
Best Practices	**Features**
Publish return policy.	Easy access to return business rules
Electronic reminders of possible scheduled maintenance.	Pull signals.
Standard inventory policy to determine excess	None Identified
Utilize real-world cases in employee training	None Identified
Evaluate the benefits of out-sourcing the excess material return process	Enables customer to focus on core competencies

Inputs	Plan	Source	Make	Deliver	Return
Process Procedures, Return Rules and Policies	P5.4				

Outputs	Plan	Source	Make	Deliver	Return
Manage Business Rules					SR1.1, SR2.1, SR3.1
Business Rules for Return Processes					P5.1, P5.2, DR1.1, DR2.1 DR3.1, ER.4, ER.5, ER.7

Enable Process: Manage Performance of Return Processes	Process Number: ER.2
Enable Process Definition	
The process of measuring actual Return Process performance against internal and/or external standards to develop and implement a course of action to achieve targeted performance levels.	
Performance Attributes	**Metric**
Reliability	Performance to requirements stated in contracts or service agreements
Responsiveness	None Identified
Flexibility	None Identified
Costs	Cost of Return Process compared to Cost of Goods Sold
Assets	None Identified
Best Practices	**Features**
Business rules are clearly communicated with the customer.	Convenient availability to business rules and return criteria
Continuous Improvement is planned through process reviews and customer feedback.	Avenue to receive customer comments

Inputs	Plan	Source	Make	Deliver	Return
Return Benchmark Data					
Process Procedures	P5.4				
Receipt Data					ER3, ER4
MRO Product Return Capabilities					ER.5

Outputs	Plan	Source	Make	Deliver	Return
MRO Product Return Capabilities	P5.2				
Return Product History					ER.3
Return Performance					ER.5, ER.6

Enable Process: Manage Return Data Collection	Process Number: ER.3
Enable Process Definition	
The process of collecting, cleansing, integrating and maintaining the accuracy of return execution information necessary to plan the recovery of supply chain resources.	
Performance Attributes	**Metric**
Reliability	Return Data Accuracy Return data system up time (%)
Responsiveness	None Identified
Flexibility	None Identified
Costs	None Identified
Assets	None Identified
Best Practices	**Features**
Data accessibility across the enterprise for visibility by discrete business units	Web based access to various levels of enterprise data
Automated update of customer excess material return transaction history	Use trend analysis to influence inventory level decisions Web-based alerts to identify update occurred and when pre-determined thresholds are exceeded.

Inputs	Plan	Source	Make	Deliver	Return
Return Product History					ER2
Data System Requirements					
Data Cleansing Procedure					

Outputs	Plan	Source	Make	Deliver	Return
Data and Return Capabilities	P5.2				
Receipt Data					DR1.3, DR2.3, DR3.3, ER.2

Enable Process: Manage Return Inventory	Process Number: ER.4
Enable Process Definition	
The process of establishing a return process inventory strategy and planning the recovery process inventory limits or levels (unserviceable carcasses ready for teardown/evaluation and those carcasses already evaluated and ready for repair) including replenishment models, ownership, product mix, and stocking locations, both inter and intra company.	
Performance Attributes	**Metric**
Reliability	Unserviceable part available to meet maintenance and repair schedule
Responsiveness	None Identified
Flexibility	None Identified
Costs	Return Inventory holding and management costs as % of (M+D) costs
Assets	Return Product Inventory Turns
Best Practices	**Features**
Periodic review of metrics and strategy with comparisons to industry benchmarks	Real time view of data.
Real time data on current status.	Dynamic calculation of safety stock based on actual sales
Cycle Counting	None Identified
Unique identifier tag (bar code, RFI tag, etc.) for each repairable asset	Asset management software.

Inputs	Plan	Source	Make	Deliver	Return
Return Plans	P5.4				
Inventory Availability					SR1.2, SR2.2, SR3.2
Return Product Location					SR1.2, SR2.2, SR3.2
Return Inventory Transfer Data					DR1.4, DR2.4, DR3.4
Business Rules for Return Processes					ER.1

Outputs	Plan	Source	Make	Deliver	Return
Return Inventory Targets	P5.2				
Inventory Availability					SR1.3, SR1.4, SR1.5, SR2.3, SR2.4, SR2.5, SR3.3, SR3.4, SR3.5
Receipt Data					DR1.3, DR2.3, DR3.3, ER.2

Return Inventory for Transfer					DR1.4, DR2.4, DR3.4

Enable Process: Manage Return Capital Assets	Process Number: ER.5
Enable Process Definition	
The process of acquiring, maintaining and dispositioning capital assets such as fork lift trucks, information systems and equipment in receiving docks that are utilized in support of Return. Management activities would include defining asset requirements, determining resource availability and conducting gap analysis and resolution. The process includes lease-buy and outsourcing decisions.	
Performance Attributes	**Metric**
Reliability	% Capital assets acquired without processing defects
Responsiveness	None Identified
Flexibility	None Identified
Costs	Total cost of return operations vs. cost of outsourcing
Assets	Cost of return capital assets / total capital assets Return Fixed Asset Costs
Best Practices	**Features**
Automated disposition instructions for returns based on data interchange with Strategic Providers	Advanced planning and scheduling capability coupled with decision support logic.
Integrated transportation visibility	Advanced shipping notices Real time shipping tracking
Automated data entry	Scan with bar-code/RFID systems
Outsource if not a core competency	Use 4PL to manage and move

Inputs	Plan	Source	Make	Deliver	Return
Return Plans	P5.4				
Business Rules for Return Processes					ER1
Return Performance					ER.2

Outputs	Plan	Source	Make	Deliver	Return
MRO Product Return Capabilities	P5.2				ER.2

Enable Process: Manage Return Transportation	Process Number: ER.6
Enable Process Definition	
The process of providing the least cost transportation of a returned product from a customer location to the appropriate service provider location within specified time frames. Can include interim transportation activities conducted within more than one service provider locations. Includes defining and implementing a Return transportation strategy throughout the supply chain, maintaining transportation-related information (rates, lead times) and managing transportation performance.	
Performance Attributes	**Metric**
Reliability	Transportation maintenance plus repair costs / total number of shipments
Responsiveness	None Identified
Flexibility	None Identified
Costs	Life cycle cost of return transportation assets and human resources /cost of outsourcing Total Discounts received / Total Discounts offered
Assets	Total transportation assets/total assets
Best Practices	**Features**
See best practices listed in Enable Deliver (ED.6)	None Identified
Limit the number of carriers, treat them as partners and build a strong relationship with each one geared toward continually improving service and lowering cost. Involve your other supply chain partners if possible to leverage transportation throughout the chain	Utilization of transportation management system (TMS) to manage returns. Maximization of TMS use, both intra and inter-company within the supply chain
Utilize invoice-less freight payment	None Identified
Develop proactive transit damage programs	None Identified
Consolidate shipments through *cross docking*. Coordinate with other shipments.	See Glossary
Utilize internet-based freight bidding built around shared shipping volume projections	None Identified
Segregate in-bound carcass return cost from other transportation costs	None Identified

Inputs	Plan	Source	Make	Deliver	Return
Return Plans	P5.4				
Return Performance					ER.2

Outputs	Plan	Source	Make	Deliver	Return
Return Transportation Guidelines, Policies, and Agreements	P5.2				

Enable Process: Manage Return Network Configuration	Process Number: ER.7
Enable Process Definition	
The process where customer and service provider locations involved in the flow of returns are defined and maintained throughout the supply chain. Locations include retail and wholesale customer and supplier sites, manufacturing facilities, distribution centers, warehouses, repair depots and military bases. How unserviceable material flow throughout the network is governed by the specific supply chain's business rules. (See ER1)	
Performance Attributes	**Metric**
Reliability	% Product returns sent to the correct location the first time
Responsiveness	None Identified
Flexibility	None Identified
Costs	Cost associated with creating or modifying product return location changes
Assets	% Cost for Return network management / Total Return asset cost
Best Practices	**Features**
Utilize web-based collaboration between customer and service provider on in-bound return forecasts and asset tracking	Shared return forecasts
Utilize web-based collaboration between Asset Manager and repair sites regarding capacity and scheduling	Total return asset visibility throughout the network
Utilize web-based collaboration to identify potential new repair sites prior to their selection	Shared knowledge of resource availability and bottlenecks
Service provider utilizes web-based communicate to identify new and discontinued repair sites to customers	Continuously updated authorized repair sites

Inputs	Plan	Source	Make	Deliver	Return
Return Plans	P5.4				
Business Rules for Return Processes					ER1

Outputs	Plan	Source	Make	Deliver	Return
Return Process Workflow Definition and Policies	P5.2				
Return Network Configuration					ER.8

Enable Process: Manage Return Regulatory Requirements and Compliance	Process Number: ER.8
Enable Process Definition	
The process of identifying and complying with regulatory documentation and process standards set by external entities (i.e. government, trade officials, etc.) when planning for the Return of Assets. Includes Customs requirements and Import / Export Controls.	
Performance Attributes	**Metric**
Reliability	% Return shipments processed without any delay due to regulatory compliance issues
Responsiveness	None Identified
Flexibility	None Identified
Costs	Administrative cost of regulatory compliance Administrative cost to implement and communicate regulation changes
Assets	% Cost for Return regulatory compliance / total Return asset cost
Best Practices	**Features**
Clarify in advance if the product to be returned requires specific, formal authorization from the service provider per federal, state or local regulation, prior to returning	Participants at all customer and service provider locations involved clearly understand all regulatory requirements at each step in the return process
Clarify in advance hazardous material packaging, labeling and shipping requirements	Overseas packaging, labeling and shipping regulatory requirements are given specific attention
Note and communicate shelf life requirements carefully before shipping	Hazardous material regulations are given specific attention
Compare local Customs requirements to your process procedures to ensure all requirements are accounted for before shipping	None Identified
Confirm all documentation and inspection requirements before shipping	None Identified

Inputs	Plan	Source	Make	Deliver	Return
Process Procedures	P5.4				
Business Rules for Return Processes					ER1
Return Network Configuration					ER7

Outputs	Plan	Source	Make	Deliver	Return
Regulatory Requirements	P5.2				DR1.3, DR2.3, DR3.3
Manage Regulatory Return Policy					SR1.1, SR2.1, SR3.1
Warranty Data					SR1.1, SR2.1

Glossary

Process and Best Practices Terms

PROCESS AND BEST PRACTICES TERMS

TERM	TYPE	DEFINITION	From Process Category/ Element #:
Access Delivery Performance	Enable Process	The process of defining the requirement and monitoring the performance of the delivery of product to a customer. When physical delivery is out-sourced the performance is passed on to source for contract administration.	ED.2
Activity Dictionary		A listing and description of work activities within business processes that provides a common/standard definition of work activities across the organization. An activity dictionary can include information about an activity and/or its relationships, such as activity description, business process, function source, degree of value-added, inputs, outputs, supplier, customer, output measures, cost drivers, attributes, tasks, and other information as desired to describe the work activity.	
Align Supply Chain Unit Plan with Financial Plan	Enable Process	The process of revising the long-term supply chain capacity and resource plans, given the inputs from the strategic and business plans. This includes revision of aggregate forecast and projections related to supply chain, source, make, and delivery plans, as well as business assumptions.	EP.9
Approve Request Authorization	Process Element	The process and actions required determining excess product and/or serviceable or obsolete products as defined by the terms and conditions of a customer/supplier contract for conformance to requirements, determining disposition profile and establishing an RPA.	SR3.5
Assess Supplier Performance	Best Practice	The process of measuring actual supplier performance against internal and/or external standards, providing feedback to achieve and maintain the performance required meeting the customers' business and/or competitive needs.	ES.2
Assess Supplier Performance	Enable Process	The process of measuring actual supplier performance against internal and/or external standards to develop and implement a course of action to achieve targeted supplier performance.	ES.2
Authorize MRO Product Return	Process Element	The process where a service provider receives an MRO product return authorization request from a customer, determines if the item can be accepted for MRO and communicates their decision to the customer. Accepting the request would include negotiating the conditions of the return with the customer, including authorizing return replacement or credit. Rejecting the request would include providing a reason for the rejection to the customer.	DR2.1
Authorize Return	Process Element	The process of validating, approving, recording, warranty claims, product recalls and non-conforming product including the processing of product replacement data and/or other similar policies including appropriate replacement.	DR1.1

Glossary

Process and Best Practices Terms

TERM	TYPE	DEFINITION	From Process Category/ Element #:
Authorize Replacement or Credit	Process Element	The process and actions required to authorize deliver of replacement product or credit to customer	SR1.7, SR3.9
Authorize Supplier Payment	Enable Process	The process of authorizing payments and paying suppliers for product or services. This process includes invoice collection, invoice matching and the issuance of checks.	S1.5, S2.5, S3.7
Balance Delivery Resources and Capabilities with Delivery Requirements	Process Element	The process of developing a time-phased course of action that commits delivery resources to meet delivery requirements.	P4.3
Balance Product Resources with Product Requirements	Process Element	The process of developing a time-phased course of action that commits resources to meet requirements.	P2.3
Balance Production Resources with Production Requirements	Process Element	The process of developing a time-phased course of action that commits creation and operation resources to meet creation and operation requirements.	P3.3
Balance Supply Chain Resources with Supply Chain Requirements	Process Element	The process of developing a time-phased course of action that commits supply-chain resources to meet supply-chain requirements.	P1.3
Best Practice	Best Practice	**A current, structured, proven and repeatable method for making a positive impact on desired operational results.** •**Current -** Must Not be emerging (bleeding edge) and must NOT be antiquated •**Structured -** Has clearly stated Goal, Scope, Process, and Procedure •**Proven** - Success has been demonstrated in a working environment. •**Repeatable -** The practice has been proven in multiple environments •**Method -** Used in a very broad sense to indicate: business process, practice, organizational strategy, enabling technology, business relationship, business model, as well as information or knowledge management. •**Positive impact on desired operational results.** - The practice shows operational improvement related to the stated goal and could be linked to Key Metric(s). The impact should show ether as gain (increase in speed, revenues, quality) or reduction (resource utilizations, costs, loss, returns, etc.). (Defined by SCC Best Practices Team, 2003)	All
Bill of Materials (BOM)	Input/Output	The Bill of Materials is a structured list of all the materials or parts needed to produce a particular finished product, assembly, subassembly, manufactured part, whether purchased or not..	EP.7
Build Loads	Process Element	Transportation modes are selected and efficient loads are built.	D1.5, D2.5, D3.5

Glossary

Process and Best Practices Terms

TERM	TYPE	DEFINITION	From Process Category/ Element #:
Business Plan	Input/Output	A document resulting from a process of linking the long-range strategy with projections of revenue, activity, cost and profit. This process develops objectives usually accompanied by budgets, projected balance sheet, and a cash flow statement.	EP.9
Capacity	Process Term	The physical facilities, personnel and process available to meet the product or service needs of customers. Capacity generally refers to the maximum output or producing ability of a machine, a person, a process, a factory, a product, or a service.	Multiple Processes
Capacity Constraints	Input/Output	A capacity constraint is said to exist when the available capacity at a resource may be insufficient to meet the workload necessary to support the desired throughput. A capacity constraint is often a bottleneck.	EP.4, EP.5, EP.6
Capacity Cost Management	Process Term	The domain of cost management that is grounded in the concept that capacity should be understood, defined, and measured for each level in the organization to include market segments, products, processes, work activities, and resources. In each of these applications, Capacity is defined in a hierarchy of idle, non-productive, and productive views.	Multiple Processes
Carcass	Term	MRO return [Not Ready for Issue (NRFI)] product	ER.4, ER.6
Checkout	Process Element	The processes and tasks associated with product checkout including scanning, method of payment, credit application and approval, service agreement, order confirmation, and/or invoice or receipt.	D4.6
Co-located Procurement Representatives	Best Practice	Regionalized Procurement Representatives are positioned in local markets to support corporate / procurement goals. Companies realize support is needed when cost and delivery objectives are not consistent with organizational goals. This leading practice involves identifying local procurement personnel to assist in creating a supply base to meet internal and external product requirements. These local representatives will perform all procurement related activities for the organization. Co-located procurement personnel bring the knowledge of the local supply base, understand their organizations demand and supply signals, and communication capability to work with company global commodity leadership.	P1
Consolidate Orders	Process Element	The process of analyzing orders to determine the groupings that result in least cost/best service fulfillment and transportation.	D1.4, D2.4
Continuous Improvement Process	Input	A process that identifies opportunities for performance improvement and facilitates their realization through the use of metrics, process development methodologies/approaches, project management principles, and reporting tools that support strategic and business plans.	EP.2

Glossary

Process and Best Practices Terms

TERM	TYPE	DEFINITION	From Process Category/ Element #:
Cost Assignment	Process Term	A distribution of costs using causal relationships. Because cost causal relationships are viewed as more relevant for management decision-making, assignment of costs is generally preferable to cost allocation techniques	Multiple Processes
Cost	Process Term	Costs are 'calculated' costs, such as product costs (i.e. outputs of work). Costs are the "use" of resource expenses. Examples of resource expenses are salaries, supplies, travel, electricity, fuel, transportation, and equipment depreciation. Resource expenses are "what was spent." In contrast, costs answer "how resources were spent" such as a product cost. Costs reflect how demands on the workload of people, equipment, and assets are consumed based on cause-and-effect relationships.	Multiple Processes
Cost Driver	Process Term	Any situation or event that causes a change in the consumption of a resource, or influences quality or cycle time. A business process may have multiple cost drivers. Cost drivers do not necessarily need to be quantified; however, they strongly influence the selection and magnitude of resource drivers and business process drivers.	Multiple Processes
Cost Driver Analysis	Process Term	The examination, quantification, and explanation of the effects of cost drivers. The results are often used for continuous improvement programs to reduce throughput times, improve quality, and reduce cost.	Multiple Processes
Cost Management	Process Term	The management and control of business processes (and work activities that belong to them) and drivers to calculate accurate product and service costs, improve business processes, eliminate waste, influence cost drivers, and plan operations. The resulting information will have utility in setting and evaluating an organization's strategies.	Multiple Processes
Cost Object	Process Term	Any product, service, channel, customer, contract, project, process or other work unit for which a separate cost measurement is desired.	Multiple Processes
CPFR®, Collaborative Planning, Forecasting, Replenishment	Best Practice	Collaborative Planning, Forecasting and Replenishment is a concept that allows collaborative processes across the supply chain, using a set of process and technology models.... (From www.cpfr.org/intro.html). CPFR® is a Registered Trademark of the Voluntary Interindustry Commerce Standards (VICS) Association	P1, P1.2, P1.3, EP.3

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Process and Best Practices Terms

TERM	TYPE	DEFINITION	From Process Category/ Element #:
Cross Docking	Best Practice	Cross docking is a practice used in many distribution centers (DC) as a strategy to reduce inventory levels by increasing inventory velocity while maintaining shipping efficiency. In a traditional DC, the receiving process is disjointed from the shipping process; storage acts as an intermediary between the two processes. Cross-docking actively links the receiving and shipping processes. Cross-docking is also an intermediate step between the storage and shipping processes to improve load efficiency. In a DC, both cross-docking (no storage) and traditional (with storage) operations might take place. Both can be considered best practices.	D1.8, D1.11, D1.12, ER.6
Customer Replenish Signal	Input/Output	A requirement for product from a distribution location to a source location.	D1.2
Deliver and/or Install	Process Element	The process of preparing and installing the product at the customer site. The product is fully functional upon completion.	D4.7
Deliver Engineer-to-Order Product	Process Category	The process of delivering product that is designed, manufactured, and assembled from a bill of materials, which includes one or more custom parts. Design will begin only after the receipt and validation of a firm customer order.	D3
Deliver Make-to-Order Product	Process Category	The process of delivering product that is manufactured, assembled or configured from standard parts or subassemblies. Manufacture, assembly or configuration will begin only after the receipt and validation of a firm customer order.	D2
Deliver Retail Products	Process Category	Deliver Retail Products are the processes used to acquire, merchandise, and sell finished goods at a retail store. A retail store is a physical location that sells products (and services) direct to the consumer using a point of sale process (manual or automated) to collect payment. Merchandising at a store level is the stocking and restocking of products in designated storage locations to generate sales in a retail store.	D4
Deliver Return Defective Product	Process Category	The processes of the last known holder or designated return center authorizing and scheduling the defective product return and the physical receipt of the item by the last known holder or known return center and their transfer of the item for final disposition determination. The process includes communication between the customer and last known holder or known return center and the generation of associated documentation.	DR1

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Process and Best Practices Terms

TERM	TYPE	DEFINITION	From Process Category/ Element #:
Deliver Return Excess Product	Process Category	The processes of the designated return center authorizing and scheduling the excess product return, the physical receipt of the item by the designated return center and transfer of the item for final disposition The process includes communication between the customer and designated return center and the generation of associated documentation.	DR3
Deliver Return MRO Product	Process Category	The processes of the service provider authorizing and scheduling the MRO return product and the physical receipt of the item by the service provider and their transfer of the item for final disposition determination. The process includes communication between the customer and service provider and the generation of associated documentation.	DR2
Deliver Stocked Product	Process Category	The process of delivering product that is maintained in a finished goods state prior to the receipt of a firm customer order.	D1
Delivered End Items	Input/Output	Products that have been acknowledged as received by the customer.	D1.12, D2.12, D3.12
Delivery Plan	Input/Output	A plan for a course of action over specified time periods that involves a projected appropriation of supply resources to meet delivery requirements.	P1.4, P4.4
Direct Cost	Process Term	A cost that can be directly traced to a cost object since a direct or repeatable cause-and-effect relationship exists. A direct cost uses a direct assignment or cost causal relationship to transfer costs.	Multiple Processes
Disposition Defective Product	Process Element	The process and actions required to bring the defective product back to operational and specifications.	SR1.6
Disposition MRO Product	Process Element	The process of the customer determining whether to service the item, what service is required, and who the appropriate service provider would be to service the item. Outputs include a decision to: (1) send a return authorization request to a service provider, (2) send the product back into service without requiring a return authorization request, or (3) discard the item.	SR2.2

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Process and Best Practices Terms

TERM	TYPE	DEFINITION	From Process Category/ Element #:
Drum-Buffer-Rope Scheduling Technique	Best Practice	The APICS Dictionary (9th Edition) defines DBR as: "In the Theory of Constraints (TOC), the generalized technique used to manage resources to maximize throughput. The drum is the rate or pace of production set by the system's constraint. The buffers establish the production against uncertainty so that the system can maximize throughput. The rope is a communication process from the constraint to the gating operation that checks or limits material released into the system to support the constraint." (Note that TOC/DBR can be referred to as Synchronous Manufacturing, Constraint Management, etc.) It is also worth mentioning that the TOC with its DBR technique and thinking processes have been applied to other fields such as project management, corporate strategy, marketing, etc.	M1.1, M2.1, M3.2
Enable PLAN	Process Category	A plan for the development and establishment of courses of action over specified time periods to appropriate delivery resources to meet projected delivery requirements. The plan contains necessary business requirements for information and relationships to effectively and efficiently PLAN the Supply Chain.	EP
Engineer-to-Order	Process Category	Production of distinct items, such as parts that retain their identity through the transformation process and are intended to be completed after receipt of a customer order, including custom products that are designed, developed, and produced in response to a specific customer request.	M3
Establish Delivery Plans	Process Element	The establishment of courses of action over specified time periods that represent a projected appropriation of supply resources to meet delivery requirements.	P4.4
Establish Production Plans	Process Element	The process that establishes courses of action over specified time periods to appropriate supply resources to meet projected production and operation plan requirements.	P3.4
Establish Sourcing Plans	Process Element	The establishment of courses of action over specified time periods that represent a projected appropriation of supply resources to meet sourcing plan requirements.	P2.4
Establish Supply Chain Plans	Process Element	Establishing time-based courses of action that attempt to appropriate and allocate supply resources to meet supply-chain plan requirements.	P1.4
Enter Order, Commit Resources & Launch Program	Process Element	The process of entering/finalizing the customers order, approving the planned resources (e.g., engineering, manufacturing, etc.) and officially launching the program.	D3.3

Glossary

Process and Best Practices Terms

TERM	TYPE	DEFINITION	From Process Category/ Element #:
ERP-based Environmental Performance Indicator module (EPI module)	Best Practice	Use of the company's ERP System to collect and evaluate environmental information in an ERP based Environmental Performance Indicator module. Environmental information in this context focuses on the use and disposal of materials and substances.	P3.3, EM.3, EM.5, EM.8
Fill Shopping Cart	Process Element	A set of tasks associated with product selection, storage and movement through to checkout.	D4.5
Finalize Engineering	Process Element	Engineering activities required after acceptance of order, but before product can be manufactured. May include generation and delivery of final drawings, specifications, formulas, part programs, etc. In general, the last step in the completion of any preliminary engineering work done as part of the quotation process.	M3.1
Fixed Asset	Financial Term	Tangible property used in the operations of a business but not expected to be consumed or converted into cash in the ordinary course of events. Plant, machinery and equipment, furniture and fixtures, leasehold improvements comprise the fixed assets of most companies. They are normally represented on the balance sheet at their net depreciated value.	EP.4, EP.5, EP.6, ED.7
Generate Stocking Schedule	Process Element	The process of scheduling resources to support item-stocking requirements.	D4.1
Identify, Assess, And Aggregate Delivery Resources and Capabilities	Process Element	The process of identifying, evaluating, and considering, as in whole with constituent parts, all things that add value in the delivery of a product or services.	P4.2
Identify, Assess, And Aggregate Product Resources	Process Element	The process of identifying, evaluating, and considering, as in whole with constituent parts, all things that add value in the material and other resources of a product or services.	P2.2
Identify, Assess, And Aggregate Production Resources	Process Element	The process of identifying, evaluating, and considering, as a whole with constituent parts, all things that add value in the creation of a product or performance of a service.	P3.2
Identify, Assess, And Aggregate Supply Chain Resources	Process Element	The process of identifying, evaluating, and considering, as in whole with constituent parts, all things that add value in the supply chain of a product or services.	P1.2
Identify MRO Product Condition	Process Element	The process where the customer utilizes pre-determined MRO policies, business rules and product operating conditions as criteria to identify and confirm that an item requires maintenance, repair, overhaul or disposal. Includes operating failures and planned maintenance requirements.	SR2.1

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Process and Best Practices Terms

TERM	TYPE	DEFINITION	From Process Category/ Element #:
Identify, Prioritize, and Aggregate Delivery Requirements	Process Element	The process of identifying, prioritizing, and considering, as a whole with constituent parts, all sources of demand in the delivery of a product or service.	P4.1
Identify, Prioritize, and Aggregate Product Requirements	Process Element	The process of identifying, prioritizing, and considering, as a whole with constituent parts, all sources of demand for a product or service in the supply chain.	P2.1
Identify, Prioritize, and Aggregate Production Requirements	Process Element	The process of identifying, prioritizing, and considering as a whole with constituent parts, all sources of demand in the creation of a product or service.	P3.1
Identify, Prioritize, and Aggregate Supply Chain Requirements	Process Element	The process of identifying, prioritizing, and considering as a whole with constituent parts, all requirements that must be satisfied by the supply chain execution.	P1.1
Indirect Cost	Process Term	A resource or business process cost that cannot be directly traced to a final cost object since no direct or repeatable cause-and-effect relationship exists. (Indirect cost and "overhead" are synonymous.) An indirect cost uses an assignment or allocation to calculate the cost of a cost object, such as a product cost.	Multiple Processes
Install Product	Process Element	The process of preparing, testing and installing the product at the customer site. The product is fully functional upon completion.	D1.14, D2.14, D3.14
Integrated Supply Chain (ISC) Plans	Input/Output	Courses of action over specified time periods that represent a projected appropriation of total supply-chain resources to meet total supply-chain demand requirements.	P1.4
Inventory Cycle Counting	Best Practice	The primary purpose of cycle counting is error detection, root cause analysis, and the elimination of problems that contribute to inaccuracy. The method used is to count on a regular basis (e.g. daily) a representative random sample of active stock keeping units.	ES.4, ES.5, ED.4, ED.5
Issue Product	Process Element	The physical movement of materials (e.g., raw materials, fabricated components, manufactured subassemblies, required ingredients or intermediate formulations) from a stocking location (e.g., stockroom, a location on the production floor, a supplier) to a specific point of use location. Issuing material includes the corresponding system transaction. The bill of materials/routing information or recipe/production instructions will determine the materials to be issued to support the manufacturing operation(s).	M1.2 M2.2 M3.3

Glossary

Process and Best Practices Terms

TERM	TYPE	DEFINITION	From Process Category/ Element #:
Item Master	Input/Output	A record of specific information for each product, which defines the system parameters with which to effectively plan and execute using ERP (MRP, etc) systems.	EP.7
Life Cycle Cost	Process Term	A product's life cycle is the period that starts with the initial product conceptualization and ends with the withdrawal of the product from the marketplace and final disposition. A product life cycle is characterized by certain defined stages, including research, development, introduction, maturity, decline, and abandonment. Life cycle cost is the accumulated costs incurred by a product during these stages.	Multiple Processes
Load Product & Generate Shipping Documentation	Process Element	The series of tasks including placing/loading product onto modes of transportation, and generating the documentation necessary to meet internal, customer, carrier and government needs. Shipping documentation includes the invoice. Optionally verify customer credit.	D1.11, D2.11, D3.11
Maintain Equipment/ Facilities	Enable Process	The ongoing management of the activities associated with ensuring equipment and facilities are kept in proper order. This process element includes required repairs, alterations, calibration, and other miscellaneous items to maintain production capability of the manufacturing fixed asset base.	EM.5
Maintain Source Data	Enable Process	The process of collecting information to support the day-to-day maintenance of all planning and execution data required supporting the sourcing process.	ES.3
Make/Buy Decision	Input/Output	The output of the process used to determine whether a demand will be supplied with internal capacity or purchased through contract manufacturing and/or contracted services externally.	EP.4, EP.5, EP.6
Make-to-Order	Process Category	Production in a Make-to-Order environment adds value to products through fabrication, assembly, mixing, separating, forming, machining and chemical processes. A Make-to-Order environment is one in which products are completed after receipt of a customer order and are built or configured only in response to a customer order.	M2
Make-to-Order - Discrete Manufacturing	Process Category	The process of manufacturing distinct items, such as parts that retain their identity through the transformation process, that is intended to be completed after receipt of a customer order. Make-to-Order includes products built only in response to a customer order and products configured in response to a customer order.	M2

Glossary

Process and Best Practices Terms

TERM	TYPE	DEFINITION	From Process Category/ Element #:
Make-to-Order - Process Manufacturing	Process Category	The process of manufacturing non-discrete products that have value added through mixing, separating, forming, and/or performing chemical reactions. Make-to-Order products are intended to be completed after receipt of a customer order. Then are built or configured only in response to a customer order.	M2
Make-to-Stock	Process Category	Production of distinct items, such as parts that retain their identity through the transformation process, that is intended to be shipped from finished goods or "off the shelf". Make-to-Stock products are completed prior to receipt of a customer order and are generally produced in accordance with a sales forecast.	M1
Make-to-Stock - Discrete Manufacturing	Process Category	The process of manufacturing distinct items, such as parts that retain their identity through the transformation process, that is intended to be shipped from finished goods or "off the shelf". Make-to-Stock products are completed prior to receipt of a customer order and are generally manufactured in accordance with a sales forecast.	M1
Make-to-Stock - Process Manufacturing	Process Category	The process of manufacturing non-discrete products that have value added through mixing, separating, forming, and/or performing chemical reactions. Make-to-Stock products are intended to be shipped from finished goods or "off the shelf," are completed prior to receipt of a customer order, and are generally produced in accordance with a sales forecast.	M1
Manage Business Rules for Plan Processes	Enable Process	The process of establishing, maintaining, and enforcing decision support criteria for Supply Chain Planning, which translate to rules for conducting business. Business rules align PLAN process performance measures with business strategy, goals, and objectives.	EP.1
Manage Business Rules for Return Processes	Enable Process	The process of establishing, maintaining, and enforcing decision support criteria for Return Planning which translate to rules for conducting business, i.e. developing and maintaining customer and channel performance standards of an return processes such as service levels, given service requirements by supply chain stakeholders/trading partners. Business rules align Return process policies with business strategy, goals, and objectives.	ER.1
Manage Capital Assets	Enable Process	Acquisition, maintenance, and disposition of the capital assets. The process of acquiring, maintaining and dispositioning an organization's <capital assets> located at a supplier's facility and/or outside source, which are used to operate the supply chain.	ES.5

Glossary

Process and Best Practices Terms

TERM	TYPE	DEFINITION	From Process Category/ Element #:
Manage Channel Standards	Enable Process	The process of developing and maintaining customer and channel performance standards of an entire supply chain such as service levels, given service requirements by supply chain stakeholders/trading partners	EP.10
Manage Deliver Business Rules	Enable Process	The process of defining and maintaining rules which affect the acceptance of an order, based on quantity, method of delivery, credit, customer experience, etc. (Include distribution channel rules)	ED.1
Manage Deliver Capital Assets	Enable Process	Acquisition, maintenance, and disposition of order management, warehouse and transportation capital assets. Determine material handling (inventory) pick pack & ship methods (inventory), and equipment.	ED.5
Manage Deliver Information	Enable Process	The process of collecting, maintaining, and communicating information to support deliver planning and execution processes. The information to be managed includes: order data (customer preference, history, status, and delivery requirements, etc.), warehouse data, transportation data, deliver data.	ED.3
Manage Finished Goods Inventories	Enable Process	The process of establishing and maintaining finished goods inventory limits or levels, replenishment models, ownership, product mix, stocking locations	ED.4
Manage Import/ Export Requirements	Enable Process	The process of identifying and complying with import/export regulatory documentation and process standards set by external entities (e.g., government).	ES.8
Manage Import/Export Requirements	Enable Process	The process of recording and maintaining regulations and rates that constrain the ordering and delivering of product. Determine customs requirements, establish letters of credit terms and conditions, etc.	ED.8
Manage Incoming Product	Enable Process	The process of defining and maintaining the information that characterizes inbound logistics management of all supplier deliveries, including both physical and electronic goods and services. This includes carrier selection and management, tracking deliveries and import.	ES.6
Manage In-Process Products (WIP)	Enable Process	Management of the activities associated with handling / storage / movement of materials used to support production.	EM.4
Manage Long-Term Supply Chain Planning	Enable Process	The process of establishing, measuring, and adjusting limits or levels of long-range supply chain capacity to meet long-range demand requirements, typically conducted at the business plan level. Key aspects of supply chain capacity include inventory, capital (fixed assets), outsource (contract manufacturing), and transportation.	EP.4, EP.5, EP.6

Glossary

Process and Best Practices Terms

TERM	TYPE	DEFINITION	From Process Category/ Element #:
Manage Make Equipment and Facilities	Enable Process	The process of specifying, maintaining and dispositioning. Make's capital assets to operate the supply chain production processes. This includes repair, alteration, calibration and other miscellaneous items to maintain production capabilities.	EM.5
Manage Performance of Return Processes	Enable Process	The process of measuring actual Return Process performance against internal and/or external standards to develop and implement a course of action to achieve targeted performance levels.	ER.2
Manage Performance of Supply Chain	Enable Process	The process of measuring actual integrated Supply Chain performance against internal and/or external standards to develop and implement a course of action to achieve targeted performance. Performance targets established for the execution of supply chain processes are reflected in the process elements for PLAN, i.e. cost, delivery reliability, cycle time, responsiveness, and assets.	EP.2
Manage Plan Data Collection	Enable Process	The process of integrating and maintaining the accuracy of information necessary to balance supply resources to demand requirements at both the highest aggregate and lowest SKU planning levels.	EP.3
Manage Planning Configuration	Enable Process	The process of defining and maintaining the information about a unique supply chain network for a group of similar or complimentary products through their full life cycle, including the evaluation of market need, product realization (development, introduction and production), product discontinuation, and after market support. This element also includes the management of critical sub processes needed to manage the life cycle of individual item numbers including item masters, routings, event planning (promotions, etc.), ABC classification, rationalization, and bill of materials.	EP.7
Manage Product Inventory	Enable Process	The process of establishing and maintaining physical inventories and inventory information. This includes warehouse management, cycle counting, physical inventories and inventory reconciliation. For Services, this may include tracking the number of service providers and the financial resources committed at any given point in time.	ES.4
Manage Production Data	Enable Process	The process of managing, collecting, maintaining, and communicating information to support MAKE planning and execution processes. The information to be managed includes production, order and process data.	EM.3

Glossary

Process and Best Practices Terms

TERM	TYPE	DEFINITION	From Process Category/ Element #:
Manage Production Performance	Enable Process	The process of developing and maintaining performance standards and analysis methods to compare actual production performance against the established standards. This process allows the development and implementation of a course of action to achieve targeted performance.	EM.2
Manage MAKE Regulatory Compliance	Enable Process	The process of identifying and complying with regulatory documentation and process standards for Make activities set by external entities (e.g. government)	EM.8
Manage Production Rules	Enable Process	The process of establishing, maintaining, and enforcing rules for managing production details in line with business strategy, goals, and objectives. Production details include part/item master, bills of materials/formulas, routings, processes, equipment requirements, tooling, and other information specifying the method of production for a particular product.	EM.1
Manage Return Capital Assets	Enable Process	The process of defining capacity utilization and recovery and then acquiring, maintaining and dispositioning an organization's capital assets as part of the overall Returns process.	ER.5
Manage Return Data Collection	Enable Process	The process of collecting, integrating and maintaining the accuracy of return execution information necessary to plan the recovery of supply chain resources.	ER.3
Manage Return Inventory	Enable Process	The process of establishing a return process inventory strategy and planning the recovery process inventory limits or levels (including Raw Material, Work In Process, Finished and Purchased Finished Goods) including replenishment models, ownership, product mix, and stocking locations, both inter and intra company.	ER.4
Manage Return Network Configuration	Enable Process	The process of defining and maintaining the information about the Returns supply chain network for a group of similar or complimentary products through their full life cycle, including the evaluation of market need, product realization (development, introduction and production), product discontinuation, and after-market support.	ER.7
Manage Return Regulatory Requirements and Compliance	Enable Process	The process of identifying and complying with regulatory documentation and process standards set by external entities (i.e. government, trade officials, etc.) when planning for the Return and Recovery of Assets.	ER.8
Manage Return Transportation	Enable Process	The process of defining a Return transportation strategy and maintaining the information, which characterizes total asset recovery transportation requirements, and the management of transporters both, inter and intra company.	ER.6

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Process and Best Practices Terms

TERM	TYPE	DEFINITION	From Process Category/ Element #:
Manage Sourcing Business Rules	Enable Process	The process of defining requirements and establishing, maintaining and enforcing decision support criteria, in line with business strategy, goals and objectives. The criteria translated into rules for conducting business within the enterprise and other legal entities including selection, negotiation, fulfillment, consideration and specific levels of collaboration.	ES.1
Manage Supplier Agreements	Enable Process	The management of existing purchase orders or supplier contracts. This includes managing volume/step pricing, resolving issues, enforcing terms and conditions and maintaining an accurate status for existing purchase orders or contracts. Also, the management of a supplier certification process, which includes certifying new suppliers and maintaining the current status of existing suppliers.	ES.9
Manage Supplier Network	Enable Process	The process of defining and maintaining a unique network of suppliers to deliver a specific product set. This includes establishment of a new supplier or maintaining an existing supplier and all the tasks and activities associated with identifying and qualifying the supplier and finalizing on the sourcing terms and conditions.	ES.7
Manage Transportation	Enable Process	The process of 1) defining and maintaining the information which characterizes product, containerization, vehicle, route, terminals, regulations, rates/tariffs and backhaul opportunity (Characterization include information necessary to support maintenance of internal Outbound Transportation equipment – CAPITAL ASSETS) and 2) the management of transporters.	ED.6
Merge-in-transit	Best Practice	Merge-in-transit is a practice used in some supply chains where customer orders require: 1) combining items from multiple sources into a single customer shipment; and/or 2) combining make to order items with make to stock items into a single shipment. This practice is usually performed in a shipper's distribution center (DC) or in a carrier's terminal. In either case, the items to be merged are essentially cross-docked from inbound receipt to outbound shipping (see Best Practice on Cross-Docking for a further discussion). Merge-in-transit might or might not require inventory to be held at the merge facility. In either case, it is imperative that suppliers have accurate forecasts of product demand from their customers.	D1.8, D1.9
MRO Product Return Capabilities	Input/Output	The capability to manage the administration and physical transfer of returned products for maintenance, repair or overhaul	P5.2, ER.2 ER.5
MRO Products	Input/Output	Products being returned for Maintenance, Repair, or Overhaul	S1.2, S2.2, DR2.4

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Process and Best Practices Terms

TERM	TYPE	DEFINITION	From Process Category/ Element #:
Order		A collection of one or more order lines representing a request to deliver specified quantities of goods or to render specific services. Further, a request (with a specific identifier as a reference) to deliver specified items or to render specific services with specific prices, dates, and quantities.	Multiple Processes
Order Backlog	Input/Output	Orders that have been received and entered into the order processing system and are in a queue waiting to be processed and shipped.	D2.3, M2.1
Outsource Plan	Input/Output	A plan that describes how a company will utilize third party business partners to provide products and services which the company chooses not to provide with internal capacity. Outsource Plans can vary in detail from simple policy statements to highly detailed plans with specifics about the third party business partners, specifications for products and services, performance expectations, and contract considerations.	EP.4, EP.5, EP.6
Pack Product	Process Element	The activities such as sorting / combining the products, packing / kitting the products, paste labels, barcodes etc. and delivering the products to the shipping area for loading.	D1.10, D2.10, D3.10
Package	Process Element	The series of activities that containerize completed products for storage or sale to end-users. Within certain industries, packaging may include cleaning or sterilization.	M1.4 M2.4 M3.5
Pick Product	Process Element	The series of activities including retrieving orders to pick, determining inventory availability, building the pick wave, picking the product, recording the pick and delivering product to packing area in response to an order.	D1.9, D2.9, D3.9
Pick Product from Backroom	Process Element	The process of retrieving restocking orders to pick, determining inventory availability, building a pick wave, picking item and quantity from a designated backroom warehouse location, recording the resulting inventory transaction, and delivering the product to point of stock.	D4.3
Plan Deliver	Process Category	The development and establishment of courses of action over specified time periods that represent a projected appropriation of supply resources to meet delivery requirements.	P4
Plan Make	Process Category	The development and establishment of courses of action over specified time periods that represent a projected appropriation of production resources to meet production requirements.	P3
Plan Source	Process Category	The development and establishment of courses of action over specified time periods that represent a projected appropriation of material resources to meet supply chain requirements.	P2

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Process and Best Practices Terms

TERM	TYPE	DEFINITION	From Process Category/ Element #:
Plan Supply Chain	Process Category	The development and establishment of courses of action over specified time periods that represent a projected appropriation of supply chain resources to meet supply chain requirements for the longest time fence constraints of supply resources.	P1
Planning Decision Policies	Input/Output	Any company policies that affect how a planning process is defined, approved, and performed.	EP.1
Process Inquiry & Quote	Process Element	Receive and respond to general customer inquiries and requests for quotes.	D1.1, D2.1
Produce and Test	Process Element	The series of activities performed upon material to convert it from the raw or semi-finished state to a state of completion and greater value. The processes associated with the validation of product performance to ensure conformance to defined specifications and requirements.	M1.3 M2.3 M3.4
Product	Process Term	The end object of a transformation process that includes physical objects, information or services. "Result of activities or processes and may include service, hardware, processed materials, software or a combination thereof; can be tangible (e.g. assemblies of processed materials) or intangible (e.g. knowledge or concepts) or a combination thereof; can be either intended (e.g. offering to customers) or unintended (e.g. pollutant or unwanted effects)."[1]	All
Product Routings	Input/Output	Product routings represent the way products are made and are integrated with the Bill of Materials. Key elements of proper Routings include proper sequence of operations, work center identification, relevant tolerances, run times, lot size and setups. The equivalent concepts for services are the workflow processes and rules.	EP.4, EP.5, EP.6, EP.7
Production Capacity	Input/Output	The total system-wide production ability to provide the maximum output of products or services.	P3.2
Production Plans	Input/Output	A master production plan used to allocate capacity among manufacturing resources and schedule finite manufacturing activities or executing the performance of a service.	P1.4, P3.4

[1] ISO 8402:1994 *Quality Management and Assurance – Vocabulary*, Geneva Switzerland, International Organization for Standardization.

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Process and Best Practices Terms

TERM	TYPE	DEFINITION	From Process Category/ Element #:
Profitability Analysis	Process Term	The analysis of profit derived from cost objects with the view to improve or optimize profitability. Multiple views may be analyzed, such as market segment, customer, distribution channel, product families, products, technologies, platforms, regions, manufacturing capacity, etc.	Multiple Processes
Projected Internal and External Capacity	Input/Output	An estimate of the amount of product or service a particular part of the business (internal capacity) or a third party business partner (external capacity) is capable of producing over a particular period of time when all factors that control the production processes are working optimally.	EP.4, EP.5, EP.6
Rated Carrier Data	Input/Output	Contract rates and tariffs from carriers by commodity, lane, mode, etc. for shipments.	D1.6, D2.6, D3.6
Receive & Verify Product by Customer	Process Element	The process of receiving the shipment by the customer (either at customer site or at shipping area in case of self-collection) and verifying that the order was shipped complete and that the product meets delivery terms.	D1.13, D2.13, D3.13
Receive, Enter & Validate Order	Process Element	Receive orders from the customer and enter them into a company's order processing system. Orders can be received through phone, fax, or electronic media. "Technically" examine orders to ensure an orderable configuration and provide accurate price. Check the customer's credit. Optionally accept payment.	D1.2
Receive, Configure, Enter & Validate Order	Process Element	Receive orders from the customer and enter them into a company's order processing system. Orders can be received through phone, fax, or through electronic media. Configure your product to the customer's specific needs, based on standard available parts or options. "Technically" examine order to ensure an orderable configuration and provide accurate price. Check the customer's credit.	D2.2
Receive Defective Product	Process Element	The process of receiving and recording a defective product against a warranty claim and/or other similar policies including appropriate replacement.	DR1.4
Receive Excess Product	Process Element	The process of recording a physical receipt of Excess product and/or serviceable or obsolete products as defined by the terms and conditions of a customer/supplier contract against an RPA	DR3.4
Receive Excess Product Return	Process Element	The process of recovering excess product and/or serviceable or obsolete products as defined by the terms and conditions of a customer/supplier contract, as available inventory and disposition excess not usable for sale.	SR3.6

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Process and Best Practices Terms

TERM	TYPE	DEFINITION	From Process Category/ Element #:
Receive MRO Product	Process Element	The process where the service provider receives and verifies the returned MRO item against the return authorization and other documentation and prepares the item for transfer.	DR2.3
Receive Product from Source or Make	Process Element	The activities such as receiving product, verifying, recording product receipt, determining put-away location, putting away and recording location that a company received from either Make or Source. May include quality inspection.	D1.8, D2.8, D3.8
Receive Product at the Store	Process Element	The activities such as receiving product, verifying, recording product receipt, determining put-away location, putting away and recording location that a company performs at its own stores. May include quality inspection.	D4.2
Recover and Disposition Excess Product	Process Element	The process of recovering excess and/or serviceable or obsolete products as defined by the terms and conditions of a customer/supplier contract product as available inventory and disposition excess not usable for sale.	SR3.8
Release Product to Deliver	Process Element	Activities associated with post-production documentation, testing, or certification required prior to delivery of product to customer. Examples include assembly of batch records fir regulatory agencies, laboratory tests for potency or purity, creating certificate of analysis, and sign-off by the quality organization.	M1.6, M2.6
Return MRO Product	Process Element	The process where the customer packages, and handles the MRO product in preparation for shipping in accord with pre-determined conditions. The product is then provided by the customer to the carrier who physically transports the product and its associated documentation to the service provider.	SR2.5
Request MRO Return Authorization	Process Element	The process of a customer requesting and obtaining authorization, from a service provider, for the return of an MRO product. In addition to discussing the MRO issue, the customer and service provider would discuss enabling conditions such as return replacement or credit, packaging, handling, transportation and import / export requirements to facilitate the efficient return of the MRO product to the service provider. The customer may need to go through several return authorization iterations with multiple service providers before authorization is received.	SR2.3
Request Return Authorization	Process Element	The process of validating, approving, and recording a Return Product Authorization (RPA) for excess inventory and/or serviceable or obsolete products as defined by the terms and conditions of a customer/supplier contract.	DR3.1
Request Return Replacement or Credit	Process Element	The process and actions required determining return replacement or credit.	DR1.2, DR3.2

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Process and Best Practices Terms

TERM	TYPE	DEFINITION	From Process Category/ Element #:
Reserve Inventory & Determine Delivery Date	Process Element	Inventory and/or planned capacity (both on hand and scheduled) is identified and reserved for specific orders and a delivery date is committed and scheduled.	D1.3, D2.3
Resource Expenses	Process Term	Economic elements applied or used in the performance of business processes or to directly support cost objects. They include people, materials, supplies, equipment, technologies and facilities. Examples of resource expenses measured are salaries, supplies, travel, electricity, fuel, transportation, and equipment depreciation.	Multiple Processes
Revised Aggregate Forecast and Projections	Input/Output	An update to the aggregate Supply-Chain Forecasts of Demand by Product Family supporting the Market/Channel Plans. Corresponding Projections, supporting Make, Source, Deliver, Inventory and Response Time Plans through the Supply-Chain are produced from these Forecasts Together, they represent balanced Supply and Demand.	EP.9
Revised Business Assumptions	Input/Output	An update to the expected cause and effect statements that are the base for the Revised Aggregate Forecast and Projections. These are reviewed periodically with actual results to verify the linkage of actual cause and effect.	EP.9
Revised Capital Plan	Input/Output	A revision to plan for capital expenditures necessitated by either changes in specific business plans or factors and assumptions affecting a business plan.	EP.4, EP.5, EP.6
ROA	Acronym	(See Return on Assets – Metrics)	
Route Shipments	Process Element	Loads are consolidated and routed by mode, lane, and location.	D1.6, D2.6, D3.6
Routing Guide	Input/Output	Information used to select modes, transportation lanes, available carriers, etc. Listing or routes, carriers & rates.	D1.6, D2.6, D3.6

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Process and Best Practices Terms

TERM	TYPE	DEFINITION	From Process Category/ Element #:
Sales and Operations Planning (S&OP)	Best Practice	A process to develop tactical plans that provide management the ability to strategically direct its businesses to achieve competitive advantage on a continuous basis by integrating customer-focused marketing plans for new and existing products with the management of the supply chain. The process brings together all the plans for the business (sales, marketing, development, manufacturing, sourcing, and financial) into one integrated set of plans. It is performed at least once a month and is reviewed by management at an aggregate (product family) level. The process must reconcile all supply, demand, and new-product plans at both the detail and aggregate levels and tie to the business plan. It is the definitive statement of the company's plans for the near to intermediate term, covering a horizon sufficient to plan for resources and to support the annual business planning process. Executed properly, the sales and operation planning process links the strategic plans for the business with its execution and reviews performance measurements for continuous improvement. (From APICS online dictionary.)	P1
Schedule MRO Return Receipt	Process Element	The process where the service provider evaluates the MRO service requirements including negotiated conditions and develops a schedule that tells the Customer when to ship the part. The scheduling activity would also inform Receiving when to expect the shipment and where to send the part, for induction or storage, upon receipt.	DR2.2
Schedule MRO Shipment	Process Element	The process where the customer develops the schedule for a carrier to pick-up and deliver the MRO product. Activities include selecting the carrier and rates, preparing the item for transfer, preparing scheduling documentation and managing overall scheduling administration.	SR2.4
Schedule Defective Product Return	Process Element	Scheduling and managing the execution of the individual return deliveries of product against an existing warranty claim, product recall and non-conforming product, and/or other similar policies including appropriate replacement.	DR1.3
Schedule Excess Product Return	Process Element	Scheduling and managing the execution of the individual return deliveries of product against an existing RPA.	DR3.3

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Process and Best Practices Terms

TERM	TYPE	DEFINITION	From Process Category/ Element #:
Schedule Production Activities	Process Element	Given plans for the production of specific parts, products, or formulations in specified quantities and planned availability of required materials, the scheduling of the operations to be performed in accordance with these plans. Scheduling includes sequencing, and, depending on the factory layout, any standards for setup and run. In general, intermediate manufacturing activities are coordinated prior to the scheduling of the operations to be performed in producing a finished product.	M1.1 M2.1 M3.2
Scheduled Receipts	Input/Output	Product due to arrive.	D1.8
Select Carriers & Rate Shipments	Process Element	Specific carriers are selected by lowest cost per route and shipments are rated and tendered.	D1.7, D2.7, D3.7
Service Levels	Input/Output	Performance targets in service related measures (i.e. delivery performance, lead times, etc.) compared to the established service requirements. Service levels are established by balancing requirements against operational strategy.	EP.10
Service Requirements	Input/Output	A set of minimum acceptable values that describe service requirements of a particular industry, channel, and/or customer segment.	EP.10
Ship Product	Process Element	The process of shipping the product to the customer site.	D1.12, D2.12, D3.12
Shipping Documents	Input/Output	Legal documentation of the contents of a shipment (e.g. way bill, bill of lading, export papers, etc....). Includes invoice (if applicable)	D1.11, D2.11, D3.11
Source Return Defective Product	Process Category	The process, initiated by the customer, of returning material deemed defective by to the last known holder or designated return center. Process includes: customer identification that an action is required and determining what that action should be, communicating with the last known holder, generating return documentation, and physically returning of the excess product.	SR1
Source Return Excess Product	Process Category	The process, initiated by the customer, of returning material deemed in excess of current requirements to the designated return center. Process includes: customer identification that an action is required, determining what that action should be, requesting authorization from the designated return center, generating return documentation, and physically returning the excess product.	SR3
Source Return MRO Product	Process Category	The process, initiated by the customer, of returning maintenance, repair, and overhaul items to a service provider. Process includes: customer identification that an action is required and determining what that action should be, communicating with the service provider, generating return documentation, and physically returning or disposing of the product.	SR2

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Process and Best Practices Terms

TERM	TYPE	DEFINITION	From Process Category/ Element #:
Sourcing Plans	Input/Output	An aggregate material requirements plan used to schedule material deliveries to meet production plans.	P1.4, P2.4
Stock Shelf	Process Element	For restocks, the tasks associated with identifying the item location, stocking the shelf according to merchandise plans, and recording the appropriate inventory transaction. For promotional items and stock repositioning the tasks associated with shelf and point of sale preparation, stock placement, and end of sale activities.	D4.4
Stage Product	Process Element	The movement of packaged products into a temporary holding location to await movement to a finished goods location. Products that are made to order may remain in the holding location to await shipment per the associated customer order. The actual move transaction is part of the Deliver process.	M1.5 M2.5 M3.6
Strategic Plan	Input/Output	A longer range, high-level plan that describes how a company intends to conduct business. Improve its market and competitive position, and increase its earnings performance.	EP.9
Supplier Carrier Agreement	Best Practice	An agreement between The Company and domestic and global carriers, inbound and outbound, specifying service levels, payment terms and other conditions	D1.10 S1.2 ES.9 ES.7 ES.2
Supply Chain Asset Management Efficiency	Performance Attribute	The effectiveness of an organization in managing assets to support demand satisfaction. This includes the management of all assets: fixed and working capital.	All
Supply Chain Costs	Performance Attribute	The costs associated with operating the supply chain.	All
Supply Chain Delivery Reliability	Performance Attribute	The performance of the supply chain in delivering: the correct product, to the correct place, at the correct time, in the correct condition and packaging, in the correct quantity, with the correct documentation, to the correct customer.	All
Supply Chain Flexibility	Performance Attribute	The agility of a supply chain in responding to marketplace changes to gain or maintain competitive advantage.	All
Supply Chain Performance Improvement Plan	Input/Output	A plan that describes goals and objectives for a supply chain and the steps that will be taken to reach those goals and objectives from the current performance levels.	EP.2
Supply Chain Performance Metrics	Input/Output	Standard measures that indicate how well a supply chain performs within certain categories of performance known as Performance Attributes, e.g. delivery reliability, flexibility and responsiveness, cost, and asset management.	EP.2
Supply Chain Responsiveness	Performance Attribute	The speed at which a supply chain provides products to the customer.	All

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Process and Best Practices Terms

TERM	TYPE	DEFINITION	From Process Category/ Element #:
Transfer MRO Product	Process Element	The process where the service provider transfers the MRO product to the appropriate process to implement the disposition decision.	DR2.4
Target Costing	Process Term	A target cost is calculated by subtracting a desired profit margin from an estimated or a market-based price to arrive at a desired production, engineering, or marketing cost. This may not be the initial production cost, but one expected to be achieved during the mature production stage. Target costing is a method used in the analysis of product design that involves estimating a target cost and then designing the product/service to meet that cost. (See Value analysis.)	Multiple Processes
Unit Cost	Process Term	The cost associated with a single unit of measure underlying a resource, business process, product or service. It is calculated by dividing the total cost by the measured volume. Unit cost measurement must be used with caution, as it may not always be practical or relevant in all aspects of cost management.	Multiple Processes
Vendor Managed Inventory (VMI)	Best Practice	The APICS Dictionary (10th edition) defines VMI as "A means of optimizing supply chain performance in which the supplier has access to the customer's inventory data and is responsible for maintaining the inventory level required by the customer. Re-supply is performed by the vendor through regularly scheduled reviews of the on-site inventory. The on-site inventory is counted, damaged or outdated goods are removed, and the inventory is restocked to predefined levels."	P1 / P2 / P4 / S1.1 / S2.1 / S3.3 / ES.7 / D1 / D1.5 / D1.6 / D2.5 / D2.6 / D3.5 / D3.6
Verify Defective Product	Process Element	The process and actions required determining the cause of defective product conformance to requirements and recording disposition profile.	SR1.5
Verify Excess Product	Process Element	The process of verifying excess product and/or serviceable or obsolete products as defined by the terms and conditions of a customer/supplier contract as available inventory and disposition excess not usable for sale.	SR3.7
Wave Picking	Best Practice	Wave picking is a practice used in many DC operations to increase labor picking productivity and reduce the labor cost per pick. In some DC's, orders are scheduled to be picked when they are received. Wave picking consolidates orders into "waves" where multiple orders with similar characteristics are picked at one time. Orders can be consolidated by customer, geography, or any other criteria that makes sense for the DC operation. In an operation where freight consolidation for shipping is important, wave picking can help consolidate less-than-truckload (LTL) shipments into truckload (TL) shipments.	D1.9

METRICS

Level 1 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).

TERM	TYPE	DEFINITION	From Process Category/ Element #:
# Of call backs as % of total inquiries	Metric	Number of callbacks divided by total inquiries.	D1.1, D2.1
% Invoices processed without issues and/or errors	Metric	The number of invoices processed without issues and or errors divided by the total number of invoices processed in the measurement period	S1.5, S2.5, S3.7
% Orders/Lines Received Complete	Metric	The number of orders / lines that are received complete divided by the total orders / lines received in the measurement period	S1.2, S2.2, S3.4
% Orders/Lines Received Damage Free	Metric	The number of orders / lines that are processed damage free divided by the total orders / lines processed in the measurement period	S1.2, S2.2, S3.4
% Orders/Lines Received Defect Free	Metric	The number of orders / lines that are received defect free divided by the total orders / lines processed in the measurement period	S1.3, S2.3, S3.5
% Orders/Lines Received On-Time To Demand Requirement	Metric	The number of orders / lines that are received on-time to the demand requirements divided by the total orders / lines for the demand requirements in the measurement period	S1.2, S2.2, S3.4
% Orders/Lines Received With Correct Shipping Documents	Metric	The number of orders / lines that are received on-time with correct shipping documents divided by the total orders / lines processed in the measurement period	S1.2, S2.2, S3.4
% Product Transferred Complete	Metric	The number of orders / lines that are transferred complete divided by the total orders / lines transferred in the measurement period	S1.4, S2.4, S3.6
% Product Transferred Damage Free	Metric	The number of product orders/lines that are transferred damage free divided by the total orders / lines processed in the measurement period	S1.4, S2.4, S3.6
% Product transferred on-time to demand requirement	Metric	The number of product orders / lines that are transferred on-time to demand requirements divided by the total orders / lines transferred in the measurement period	S1.4, S2.4, S3.6
% Product transferred without transaction errors	Metric	The number of transactions processed without error divided by the total transactions processed in the measurement period	S1.4, S2.4, S3.6
% Schedules changed within Supplier's Lead Time	Metric	The number of schedules that are changed within the suppliers lead-time divided by the total number of schedules generated within the measurement period	S1.1, S2.1, S3.3
% Schedules generated within Supplier's Lead Time	Metric	The number schedules generated within the suppliers lead-time divided by the total schedules generated in the measurement period	S1.1, S2.1, S3.3

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Metrics

TERM	TYPE	DEFINITION	From Process Category/ Element #:
Actual Asset Life Maintenance Cost as % of Replacement Value	Metric	Measure of total lifecycle maintenance cost of an asset compared to its replacement cost. This ratio is based maintenance cost to-date so that that replacement or upgrade cost can be evaluated as the asset ages on an on-going basis.	EM.5
Administrative Costs Associated with In-Transit Handling/Movement of In-Process Product	Metric	The cost of planning and scheduling for labor, training, storage, and transportation for In-Process product. Included are the documentation activities of managing, processing, updating, maintaining and storage of documentation.	EM.6
Asset Turns	Metric	Total gross product revenue ÷ Total net assets	M1, M1.3, M1.4, M2, M2.3, M2.4, M3, M3.4, M3.5
Average days per Engineering Change	Metric	# of days each engineering change impacts the delivery date divided by the total # of changes.	S1.1, S2.1, S3.3
Average days per Schedule Change	Metric	# of days each schedule change impacts the delivery date divided by the total # of changes.	S1.1, S2.1, S3.3
Average Plant-Wide Salary	Metric	Total payroll for salaried employees divided by total headcount	M2, M3
Average Release Cycle of Changes	Metric	Cycle time for implementing change notices divided by total number of changes.	S1.1, S2.1, S3.3
Capacity Utilization	Metric	A measure of how intensively a resource is being used to produce a good or service. Some factors that should be considered are internal manufacturing capacity, constraining processes, direct labor availability and key components/materials availability.	P1, P1.3, M1, M1.1, M1.3, M1.4, M2, M2.1, M2.3, M3, M3.1, D2.3
Cash-to-Cash Cycle Time	Metric	Cash-to-cash cycle time = inventory days of supply + days sales outstanding – average payment period for materials (time it takes for a dollar to flow back into a company after its been spent for raw materials). For services, this represents the time from the point where a company pays for the resources consumed in the performance of a service to the time that the company received payment from the customer for those services.	P1, M1.2, M2.2, M3.3, D2.12, D3.11
Commodity Management Profile	Metric	Number of distinct part numbers (purchased commodities) or service components/ resources sourced within the following areas: 200 miles, own country, own continent, and off - shore.	P2, P2.2, P2.4
Cost of compliance including administrative costs	Metric	Total MAKE cost to comply with regulatory requirements.	EM.8
Cost of Goods Sold	Metric	The cost associated with buying raw materials and producing finished goods. This cost includes direct costs (labor, materials) and indirect costs (overhead).	All

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Metrics

TERM	TYPE	DEFINITION	From Process Category/ Element #:
Cost Of In-Process Product (WIP) Damaged from Handling/Storage as a Percentage of Total Material Cost	Metric	The costs of in-process product (WIP) damaged from handling/storage divided by the total cost of those materials.	EM.4, EM.6
Cost of Managing MAKE Information	Metric	The cost of managing, updating, and maintaining the information technology systems that support manufacturing operations.	EM.3
Cost of Noncompliance	Metric	Measure of the MAKE costs for non-conformance with regulatory documentation and process standards set by external entities (e.g. government).	EM.8
Cost per Invoice	Metric	All costs associated with the receipt, review, processing, and payment of a supplier's invoice for product received.	S1.5, S2.5, S3.7
Costs Associated with Managing Production Performance as a % Manufacturing Controllable Cost	Metric	Ratio of Cost for Managing Production Performance to Manufacturing Controllable Cost.	EM.2
Create Customer Order Costs	Metric	Includes costs for creating and pricing configurations to order and preparing order documents.	D1.2, D2.2, D3.2
Cross training	Metric	The providing of training or experience in several different areas (e.g., training an employee on several machines rather than one). Cross - training provides backup workers in case the primary operator is unavailable.	M3.2
Customer Invoicing/ Financial Accounting Costs	Metric	Includes costs for invoicing, processing customer payments, and verifying customer satisfaction.	D1.13, D2.12, D3.11
Damage and Shrinkage	Metric	Reductions of actual quantities of items in stock, in process, or in transit. The loss may be caused by scrap, theft, deterioration, evaporation, etc.	R1, D4
Days Sales Outstanding	Metric	5 point annual average of gross accounts receivable ÷ (total gross annual sales ÷ 365)	D1.13, D2.12, D3.11
Delivery Performance to Customer Commit Date	Metric	The percentage of orders that are fulfilled on or before the original scheduled or committed date.	P1.3, P4.3, P4.4, M3.1, D1.3, D1.11, D2, D2.11, D3.11
Demand/Supply Planning Costs	Metric	Costs associated with forecasting, developing finished goods or end item inventory plans, and coordinating Demand/Supply process across entire supply chain, including all channels. (Not including MIS associated costs.)	P1
Distribution Costs	Metric	Includes costs for warehouse space and management, finished goods receiving and stocking, processing shipments, picking and consolidating, selecting carrier, and staging products/systems.	D1.8, D1.9, D2.4, D2.5, D2.6, D2.7, D2.8, D3.5, D3.6, D3.7

Glossary

Metrics

TERM	TYPE	DEFINITION	From Process Category/ Element #:
Documentation	Metric	Number of orders without correct documentation supporting the order, including packing slips, bills of lading, invoices, etc.	D2.8
Downside Deliver Adaptability	Metric	The reduction in delivered quantities sustainable at 30 days prior to delivery with no inventory or cost penalties.	D1, D1.2, D2.2, D1.5, D1.8, D1.9, D1.10, D1.11, D1.12, D1.13 D2, D2.5, D2.8, D2.9, D2.10, D2.11, D2.12 D3, D3.2, D3.3, D3.4, D3.5, D3.7, D3.8, D3.9, D3.10, D3.11
Downside Make Adaptability	Metric	The production reduction sustainable at 30 days prior to delivery with no inventory or cost penalties.	M1, M2, M3
Downside Source Adaptability	Metric	The raw material quantity reduction sustainable at 30 days prior to delivery with no inventory or cost penalties.	S1, S2, S3
Downside Supply Chain Adaptability	Metric	The reduction in quantities ordered sustainable at 30 days prior to delivery with no inventory or cost penalties.	P1, P2, P3, P4, S1, S2, S3, M1, M2, M3, D1, D2, D3
ECO cost	Metric	Costs incurred from revisions to a blueprint or design released by engineering to modify or correct a part. The request for the change can be from a customer or from production quality control or another department.	M3, M3.1
End-of-Life Inventory	Metric	Inventory on hand which will satisfy future demand for products that are no longer in production at your entity.	D1.8
Equipment Utilization	Metric	Number of filled equipment SKU locations divided by the total SKU locations provided by the equipment expressed as a percentage	EM.4
Equipment/Facility Maintenance Cost as % of Manufacturing Controllable Cost	Metric	Cost to repair, alter, calibrate and maintain production equipment divided by total Manufacturing Controllable Cost.	EM.5
Field Finished Goods Inventory Days of Supply	Metric	The inventory which is kept at locations outside the four walls of the manufacturing plant, i.e. distribution center, warehouse.	D2.9, D2.11, D3.10
Fill Rates	Metric	The percentage of ship-from-stock orders shipped within 24 hours of order receipt. For services, this metric is the proportion for services that are filled so that the service is completed within 24 hours	P1, P1.3, P4, P4.4, M1.3, D1, D1.3, D1.9, D2
Finished Goods Inventory Carrying Costs	Metric	Sum of all costs associated with finished goods inventory: opportunity cost, shrinkage, insurance and taxes, total obsolescence, channel obsolescence and field sample obsolescence.	D1.3

Glossary

Metrics

TERM	TYPE	DEFINITION	From Process Category/ Element #:
Finished Goods Inventory Days of Supply	Metric	Finished goods inventory days of supply are calculated as gross finished goods inventory ÷ (value of transfers/365 days).	P4, P4.4, D1, D1.3, D1.8, D2, D3, D3.8
Finished Goods Inventory Days of Supply	Metric	Plant finished goods inventory days of supply are calculated as gross plant finished goods inventory ÷ (value of transfers/365 days).	M1.5, D2.8, D3.7
Forecast Accuracy	Metric	Forecast accuracy is calculated for products and/or families for markets/distribution channels, in unit measurement. Forecast Accuracy = Forecast Sum - Sum of Variance/Forecast Sum Where: Forecast Sum = The sum of the units forecasted to be shipped in each month based upon the forecast generated at the critical time fence. Sum of Variances = The sum of the absolute values, at the forecasted line item level, of the differences between each month's forecast as defined above and actual demand for the same month.	EP.4, EP.5, EP.6, EP.7, P1, P1.1, P2.1, P3.1, P4, P4.1, P4.2
Forecast Cycle	Metric	The time between forecast regenerations that reflect true changes in marketplace demand for deliverable end products. Only true "bottoms-up" forecasts are counted: for example, if weekly or monthly updates to the forecast only re-calendar or shift dates for the forecast to avoid changing the annual dollar-based forecast, they should not be considered true forecast regenerations.	P1.1, P2.1
Frequency of Replenishment	Metric	Also “replenishment interval” is the time between successive replenishment orders.	P2
Indirect to Direct Labor Headcount Ratio	Metric	Ratio of total number of employees required to support production in general without being related to a specific product, indirect labor, to the total number of employees that is specifically applied to the product being manufactured or used in the performance of the service, direct labor.	M1, M2, M3
Installation Costs	Metric	Includes costs for verifying site preparation, installing, certifying, and authorizing billing.	D2.11, D3.10
Intra-Manufacturing Re-Plan Cycle	Metric	Time between the acceptance of a regenerated forecast is by the end-product producing location and the reflection of the revised plan in the master production schedule of all the affected plants, excluding external vendors.	M1.3, M2.3, M3.4
Inventory Aging	Metric	The percentage of total gross inventory (based on value) covered by expected demand within specific time buckets.	M1, M2, M3
Inventory Cycle Counting Accuracy	Metric	The absolute value of the sum of the variance between physical inventory and perpetual inventory. Or the number of accurate part cycle counts divided by the total number of cycle counts performed expressed as a percentage.	EM.4

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Metrics

TERM	TYPE	DEFINITION	From Process Category/ Element #:
Inventory Days Of Supply	Metric	Total gross value of inventory at standard cost before reserves for excess and obsolescence. Only includes inventory on company books, future liabilities should not be included. Five point annual average of the sum of all gross inventories (raw materials & WIP, plant FG, field FG, field samples, other) ÷ (COGS ÷ 365).	P1, P1.3, S1, S1.4, S2, S2.4, S3, S3.6, M1.1, M2.1, M3.2
Inventory Obsolescence as a % of Total Inventory	Metric	The annual obsolete and scrap reserves taken for inventory obsolescence expressed as a percentage of annual average gross inventory value.	M1, M1.2, M2.1, M2.2, M3.3, D1.8, D2
Manufacturing Controllable Cost	Metric	All costs under direct control of the MAKE function. These costs are: direct labor and expenses, indirect labor and expenses, asset charges, and excess material & packaging costs. (Raw and packaging materials used to make a finished good are not included.)	EM.2, EM.3, EM.5
Mean Time Between Failure	Metric	The average time interval between failures for repairable equipment and facilities for a defined unit of measure (e.g. operational hours, cycles, miles).	EM.5
Mean Time to Repair Asset	Metric	The average time to repair equipment and facilities for a defined unit of measure (e.g. operational hours, cycles, miles).	EM.5
Number of ECOs	Metric	Total number of revisions to a blueprint or design released by engineering to modify or correct a part, engineering change orders (ECO). The request for the change can be from a customer or from production quality control or another department.	M3, M3.1
Number of Supply Sources	Metric	Total number of internal and external direct production material suppliers used.	P2, P2.2, P2.4
On Time in Full	Metric	Number of orders for which not all of the items on order are delivered in the quantities requested.	D2.8
Order Consolidation Profile	Metric	Consolidation: is defined as the activities associated with filling a customer order by bringing together in one physical place all of the line items ordered by the customer. Some of these may come directly from the production line and others may be picked from stock. The following profiles have been captured: Shipped direct to customer's dock from point of manufacture (No Consolidation). Shipped direct to the customer with consolidation completed, local to customer by your transport company. Moved to on-site staging location for consolidation and shipment direct to customer. Moved to on-site stockroom for later pick, pack and ship. Shipped to different locations for consolidation or later pick, pack and ship.	D1.4

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Metrics

TERM	TYPE	DEFINITION	From Process Category/ Element #:
Order Entry and Maintenance Costs	Metric	Includes costs for maintaining the customer database, credit check, accepting new orders and adding them to the order system as well as later order modifications.	D1.2, D2.2
Order Fulfillment Costs	Metric	Includes costs for processing the order, allocating inventory, ordering from the internal or external supplier, scheduling the shipment, reporting order status and initiating shipment.	D1.3, D2.3, D3.3, D3.4
Order Fulfillment Cycle Time	Metric	The average actual cycle time consistently achieved to fulfill customer orders. For each individual order this cycle time starts from the order receipt and ends with customer acceptance of the order. This cycle time consists of a ‘gross’ component and a ‘net’ component defined as Order Fulfillment Process Time, according to the following formula: Order Fulfillment Cycle Time = Order Fulfillment Process Time + Order Fulfillment Dwell Time. Note that dwell time will equal 0 for companies who do not utilize this metric, so Order Fulfillment Cycle Time will equal Order Fulfillment Process Time. .	S3.1-S3.7 M2.1-M2.6 M3.1-M3.7 D1.2-D1.14 D2.2-D2.7 D2.8-D2.14 D3.3-D3.7 D3.8-D3.14
Order Fulfillment Dwell Time	Metric	Any lead time during the order fulfillment process where no activity takes place, which is imposed by customer requirements. Note that this dwell time is different from ‘idle time’ or ‘non-value-add lead time’, which is caused by inefficiencies in the organization’s processes and therefore ultimately under responsibility of the organisation. This kind of idle time should not be deducted from Order Fulfillment Cycle Time.	
Order Management Costs	Metric	The aggregation of the following cost elements (contained in this glossary): Create Customer Order Costs Order Entry and Maintenance Costs Contract/Program and Channel Management Costs Installation Planning Costs Order Fulfillment Costs Distribution Costs Transportation Costs Installation Costs Customer Invoicing/Accounting Costs	D1, D1.1, D2, D2.1, D3, D3.1
Overhead Cost	Metric	Costs incurred in the operation of a business that cannot be directly related to the individual products or services produced. These costs, such as light, heat, supervision, and maintenance, are grouped in several pools and distributed to units of product or service by some standard allocation method such as direct labor hours, direct labor dollars, or direct materials dollars.	M1, M2, M3
Packaging Cost	Metric	The cost to package product as a finished good, not including intermediate handling of materials, based on given number of Delivered Finished Goods.	M1.4, M2.4, M3.5

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Metrics

TERM	TYPE	DEFINITION	From Process Category/ Element #:
Perfect Order Fulfillment	Metric	A “perfect order” is defined as an order that meets all of the following standards: Delivered complete; all items on order are delivered in the quantities requested Delivered on time to customer’s request date, using the customer’s definition of on-time delivery Documentation supporting the order including packing slips, bills of lading, invoices, etc., is complete and accurate Perfect condition: Faultlessly installed (as applicable), correct configuration, customer-ready, no damage	D1.10, D1.11, D2, D2.2, D2.9, D2.10, D3, D3.8, D3.9
Placement Information (RFID)	Metric	Placement information as measured by RFID	P2, P4
Plant Cost Per Hour	Metric	Total planning expenditures divided by the total number of hours spent exercising the plan	M1, M2
Plant-Level Order Management Costs	Metric	The aggregation of the following cost elements for which manufacturing is central focal point of orders (contained in this glossary): Create Customer Order Costs Order Entry and Maintenance Costs Contract/Program and Channel Management Costs Installation Planning Costs Order Fulfillment Costs Distribution Costs Transportation Costs Installation Costs Customer Invoicing/Accounting Costs	M2.1, M3.2
Product Acquisition Costs	Metric	Product acquisition costs include costs incurred for the production of product: sum of product management and planning, supplier quality engineering, inbound freight and duties, receiving and product storage, incoming inspection, product process engineering and tooling costs.	S1, S2, S3, D1.8
Product Losses (Sourced/in-process/finished)	Metric	The total cost of lost material from receipt and inspection of raw materials to the shipping of the finished good, per given number of Inventory Turns or Delivered Finished Goods.	M1, M2, M3
Product Management and Planning Costs as a % of Product Acquisition Costs	Metric	Product (Commodity) Management and Planning – All costs associated with supplier sourcing, contract negotiation and qualification and the preparation, placement, and tracking of a Purchase Order expressed as a percentage of product acquisition costs. This category includes all costs related to buyer/planners.	S1.1, S2.1, S3.2, S3.3
Product Process Engineering as a % of Product Acquisition Costs	Metric	Product Process Engineering – Cost associated with tasks required to document and communicate product specification, as well as reviews to improve the manufacturability of the purchased item expressed as a percentage of product acquisition costs.	S3.1

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TERM	TYPE	DEFINITION	From Process Category/ Element #:
Product Structure	Definition	Recipes / formulas / BOMs / that define the composition of a product	EM.1
Production Material Administrative Cost	Metric	Administrative costs associated with the handling / storage / movement of materials	EM.4
Production Material Handling Cost	Metric	Cost of handling/movement of materials used to support production.	EM.4
Production Material Handling Damage	Metric	Cost of material damaged from handling / storage / movement as a percentage of total material cost.	EM.4
Production Material Storage Cost	Metric	Cost of storage space used for the production materials.	EM.4
Production Plan Adherence	Metric	Production Plan Adherence is calculated at the shippable end-product level in units, using the following formula: Production Plan - Sum of Variance Production Plan Where: Production Plan = The sum of the units planned to be completed (i.e., placed into inventory or shipped) in each month based upon the plan generated in the previous month. Sum of Variances = The sum of the absolute values, at the end item level, of the differences between each month's production plan as defined above and actual production for the same month.	P3, P3.4
Production Rules Preparation Cycle Time (PRPCT)	Metric	Total Time from demand rules for production rules until releases of production details.	EM.1
Published Order Fulfillment Lead Time	Metric	The typical standard lead time to fulfill orders currently published to customers by the sales organization.	S3.1-S3.7 M2.1-M2.6 M3.1-M3.7 D1.2-D1.14 D2.2-D2.7 D2.8-D2.14 D3.3-D3.7 D3.8-D3.14
Purchased Product by Geography	Metric	Number of the following distinct part numbers of: Raw materials, Externally manufactured intermediates, Toll manufactured finished products, Packaging product, Labeling product that are sourced within the following areas: 200 miles, Own country, Own continent, Off-shore.	S3.1
Ratio Of Actual To Theoretical Cycle Time	Metric	The ratio of the measured time required for completion of a set of tasks divided by the sum of the time required to complete each task based on the rated efficiency of the machinery and labor operations.	M1.3, M1.4, M2.3, M3.4
Ratio of the Cost of Managing MAKE Information/ Manufacturing Controllable Costs	Metric	The ratio of these two metrics provides an understanding into the effect of IT on the Make operating cost.	EM.3

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Metrics

TERM	TYPE	DEFINITION	From Process Category/ Element #:
Raw Material & WIP Inventory Days of Supply	Metric	Raw material & WIP inventory days of supply are calculated as gross raw material and WIP inventory ÷ (value of transfers/365 days).	P2, P3, D2, D3
Raw Material or Product Days-of-Supply	Metric	Raw material or product inventory days of supply are calculated as gross raw material or product inventory ÷ (value of transfers/365 days).	M1.2
Raw Material Shrinkage	Metric	The costs associated with breakage, pilferage, and deterioration of raw material inventories.	P2
Receiving Accuracy	Metric	A measure of receipt conformity of recorded values to the actual values.	S1
Receiving & product storage costs as a % of Product Acquisition Costs	Metric	Receiving and Product Storage – All costs associated with taking possession of and storing product. Includes warehouse space and management, product receiving and stocking, processing work orders, pricing, and internal product movement. This does not include incoming inspection.	S1.3, S2.3, S3.5
Receiving costs as a % of Product Acquisition Costs	Metric	All costs associated with taking possession of product expressed as a percentage of product acquisition costs. This does not include inspection.	S1.2, S2.2, S3.4
Return on Supply Chain Fixed Assets	Metric	Return on Supply Chain Fixed Assets measures the return an organization receives on its invested capital in supply chain fixed assets. This includes the fixed assets used in Plan, Source, Make, Deliver, and Return. The levels of aggregation can be at any element associated with a supply chain asset. Return on Supply Chain Fixed Assets = (Supply Chain Revenue – COGS – Supply Chain Management Costs) / Supply-Chain Fixed Assets	Multiple Processes
Sales Per Employee	Metric	Total product revenue divided by total number of full-time equivalent employees	P1
Schedule Achievement	Metric	The percentage of time that a plant achieves its production schedule. This calculation is based on the number of scheduled end-items or total volume for a specific period. Note: over-shipments do not make up for under-shipments.	M1.1, M2.1, M3.2
Scheduled Resource Cost	Metric	The measure of the cost of people, information systems, management direction, and any other costs associated with provided schedules for manufacturing.	M1.1, M2.1
Scrap expense	Metric	Expenses incurred from material falling outside of specifications and possessing characteristics that make rework impractical.	M1.3, M2.3, M3.4
Shrinkage	Metric	The costs associated with breakage, pilferage, and deterioration of inventories.	P4
SKU	Metric	Stock keeping unit	EM.4
SKU Turnover	Metric	The number of times a SKU cycles or turns over in year; divide the average inventory level into the annual cost of sales – APICS.	P2, P4

TERM	TYPE	DEFINITION	From Process Category/ Element #:
Sourcing Costs as a % of Product Acquisitions Costs	Metric	All costs associated with the identification of potential suppliers, evaluation of RFQ's and supplier qualifications and the generation of a contract expressed as a percentage of product acquisition costs.	S3.2
Stock Outs or In Stocks	Metric	A lack of materials, components, or finished goods that are needed.	P4, D1, D4
Storage Space Utilization	Metric	Volume of all materials stored divided by the total volume of the storage facility expressed as a percentage.	EM.4
Supplier Fill Rate	Metric	The percentage of time a supplier completes a commitment to a customer to ship or deliver an order within 24 hours.	P2, P2.4
Supplier On-Time Delivery Performance	Metric	The percentage of orders that are fulfilled on or before the original customer requested date (suppliers performance measured by the customer).	P2, P2.3, P2.4
Supply Chain Capital Assets	Metric	A supply chain capital asset plan is an output of the Manage Integrated Supply Chain Fixed Assets (EP.5) process element and would contain supply chain capital asset information that could be used in measuring the Supply Chain Fixed Assets. • Plan Fixed Asset - The current value of the supply chain assets used in supply chain integration (See EP.5) • Source Fixed Asset - The current value of the supply chain assets used in the Source process. (See ES.5) • Make Fixed Asset - The current value of the supply chain assets used in the Make process. (See EM.5) • Deliver Fixed Asset - The current value of the supply chain assets used in the Deliver process. (See ED.5) • Return Fixed Asset - The current value of the supply chain assets used in the Return process. (See ER.5)	EP.5, ES.5, EM.5, ED.5, ER.5
Supply Chain Finance Costs	Metric	Costs associated with paying invoices, auditing physical counts, performing inventory accounting, and collecting accounts receivable. (Does not include customer invoicing/accounting costs.)	P1.3
Supply Chain Management Costs	Metric	Costs associated with the supply chain including execution, administration, and planning.	P1, P2, P3,

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Metrics

TERM	TYPE	DEFINITION	From Process Category/ Element #:
Supply Chain Revenue	Metric	Operating revenue generated from a supply chain. Does not include non-operating revenue, such as leasing real estate, investments, court settlements, sale of office buildings, etc. Supply Chain Revenue is used rather than Net Revenue. Supply Chain Revenue is calculated as: Supply Chain Revenue - COGS - Total Supply Chain Management Costs. This provides the revenue generated through the supply chain less the total costs associated with the supply chain.	P1
Time Interval Between a Performance Standard Request and Availability.	Metric	The time interval from the receipt of a performance standard request and the availability of the standard.	EM.2
Time to Comply with Regulatory Changes	Metric	Time interval between regulatory change issuance and implementation of the change.	EM.8
Total Deliver Costs	Metric	Costs associated with the Deliver Processes including execution, administration, and planning.	P4
Total Internal and/or External Costs That Are The Result Of Inaccurate Production Rule Details	Metric	Direct and indirect costs that can be attributed to inaccurate production details. Includes rework, scrap, recalls, preparation, etc.	EM.1
Total WIP Inventory DOS	Metric	Total WIP inventory days of supply are calculated as gross WIP inventory ÷ (value of transfers/365 days).	P3, P3.3, P3.4
Training/ Education	Metric	The total number of programs aimed at new work methods for experienced workers and short courses in current practices for new employees to increase productivity.	M1.3, M2.3
Transfer and Product Storage Costs as a % of Product Acquisition Costs	Metric	All costs associated with the storage and/or movement of the product to the next appropriate stocking location (transfer point) in the supply chain expressed as a percentage of product acquisition costs.	S1.4, S2.4, S3.6
Transportation Costs	Metric	Includes all company paid freight and duties from point of manufacture to end-customer or channel.	D1.4, D1.5, D1.6, D1.7, D2.9, D3.8
Unit Cost	Metric	Total labor, material, and overhead cost for one unit production, e.g., one part, one gallon, one pound.	M2, M3

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Metrics

TERM	TYPE	DEFINITION	From Process Category/ Element #:
Upside Deliver Adaptability	Metric	The maximum sustainable percentage increase in quantities delivered that can be achieved in 30 days with the assumption of no other constraints.	D1, D1.2, D2.2, D1.5, D1.8, D1.9, D1.10, D1.11, D1.12, D1.13 D2, D2.5, D2.8, D2.9, D2.10, D2.11, D2.12 D3, D3.2, D3.3, D3.4, D3.5, D3.7, D3.8, D3.9, D3.10, D3.11
Upside Deliver Flexibility	Metric	The number of days required to achieve an unplanned sustainable 20% increase in quantity delivered with the assumption of no other constraints.	D1, D1.2, D2.2, D1.5, D1.8, D1.9, D1.10, D1.11, D1.12, D1.13 D2, D2.5, D2.8, D2.9, D2.10, D2.11, D2.12 D3, D3.2, D3.3, D3.4, D3.5, D3.7, D3.8, D3.9, D3.10, D3.11
Upside Make Adaptability	Metric	The maximum sustainable percentage increase in production that can be achieved in 30 days with the assumption of no other constraints.	M1, M2, M3
Upside Make Flexibility	Metric	The number of days required to achieve an unplanned sustainable 20% increase in production with the assumption of no other constraints.	M1, M2, M3
Upside Source Flexibility	Metric	The number of days required to achieve an unplanned sustainable 20% increase in quantity of raw materials.	S1, S2, S3
Upside Source Adaptability	Metric	The maximum sustainable percentage increase in raw material quantities that can be acquired/received in 30 days.	S1, S2, S3
Upside Source Return Adaptability	Metric	The maximum sustainable percentage increase in returns of raw materials to suppliers that can be achieved in 30 days with the assumption of unconstrained finished goods availability. Upside Deliver Return Adaptability: The maximum sustainable percentage increase in returns of finished goods from customers that can be achieved in 30 days.	SR1, SR2, SR3
Upside Source Return Flexibility	Metric	The number of days required to achieve an unplanned sustainable 20% increase in the return of raw materials to suppliers. Upside Deliver Return Flexibility: The number of days required to achieve an unplanned sustainable 20% increase in the return of finished goods from customers.	SR1, SR2, SR3

Glossary
Metrics

TERM	TYPE	DEFINITION	From Process Category/ Element #:
Upside Supply Chain Adaptability	Metric	The maximum sustainable percentage increase in quantity delivered that can be achieved in 30 days.	P1, P2, P3, P4, S1, S2, S3, M1, M2, M3, D1, D2, D3
Upside Supply Chain Flexibility	Metric	The number of days required to achieve an unplanned sustainable 20% increase in quantities delivered. The calculation of supply chain flexibility requires the calculation to be the minimum time required to achieve the unplanned sustainable increase when considering Source, Make, and Deliver components. For example, if it requires 90 days achieve a 20% increase in raw material volume, 60 days for adding capital to support production, and no time to increase the ability to deliver, upside supply chain flexibility would be 90 days (if production changes can run concurrently with material acquisition activities) or as much as 150 days if production changes and material acquisition changes must run sequentially.	P1, P2, P3, P4, S1, S2, S3, M1, M2, M3, D1, D2, D3
Validation Frequency	Metric	The amount of time between reviews of a process. For example, Production Process Validation Frequency would refer to the amount of time between the reviews of the Production Process. This generally would be performed periodically to ensure that the process is generating the desired results with the desired inputs.	EM.3
Value of assets provided by service provider (cost avoidance)	Metric	Value of process and/or procedure provided by a service provider that directly results in cost savings in reviewing and selecting a source.	S3, S3.1
Value-Added Employee Productivity	Metric	Value added per employee is calculated as total product revenue less total material purchases ÷ total employment (in full-time equivalents).	M1, M1.3, M2, M2.3, M3, M3.4
Verification Costs as a % of Product Acquisition Costs	Metric	All costs associated with verifying the product meets all quality and contract specifications expressed as a percentage of product acquisition costs.	S1.3, S2.3, S3.5
Warranty and Returns	Metric	Number of returns within the warranty period. Warranty is a commitment, either expressed or implied, that a certain fact regarding the subject matter of a contract is presently true or will be true.	M1.3, M1.4
Warranty Costs	Metric	Warranty costs include materials, labor and problem diagnosis for product defects.	M1, M1.3, M1.4, M2, M2.3, M2.4, M3, M3.4, M3.5
Yield Variability	Metric	The condition that occurs when the output of a process is not consistently repeatable either in quantity, quality, or combination of these.	M1.3, M2.3, M3.4

APPENDIX A - Metrics

APPENDIX A
Metrics

Background Development Information

2004 Metrics Project Team

Performance Attributes and Associated Level 1 Metrics

Performance Attribute	Performance Attribute Definition	Level 1 Metric
Supply Chain Reliability	The performance of the supply chain in delivering: the correct product, to the correct place, at the correct time, in the correct condition and packaging, in the correct quantity, with the correct documentation, to the correct customer.	Perfect Order Fulfillment
Supply Chain Responsiveness	The speed at which a supply chain provides products to the customer.	Order Fulfillment Cycle Time
Supply Chain Flexibility	The agility of a supply chain in responding to marketplace changes to gain or maintain competitive advantage.	Upside Supply Chain Flexibility Upside Supply Chain Adaptability Downside Supply Chain Adaptability
Supply Chain Costs	The costs associated with operating the supply chain.	Supply Chain Management Cost Cost of Goods Sold
Supply Chain Asset Management	The effectiveness of an organization in managing assets to support demand satisfaction. This includes the management of all assets: fixed and working capital.	Cash-to-Cash Cycle Time Return on Supply Chain Fixed Assets

Performance Attributes and Level 1 Metrics

Level 1 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	
	Reliability	Responsiveness	Flexibility	Costs	Assets
Perfect Order Fulfillment	X				
Order Fulfillment Cycle Time		X			
Upside Supply Chain Flexibility			X		
Upside Supply Chain Adaptability			X		
Downside Supply Chain Adaptability			X		
Supply Chain Management Cost				X	
Cost of Goods Sold				X	
Cash-To-Cash Cycle Time					X
Return on Supply Chain Fixed Assets					X

Level 1 Metric: Perfect Order Fulfillment

Definition: The percentage of orders meeting delivery performance with complete and accurate documentation and no delivery damage. Components include all items and quantities on-time using customer's definition of on-time, and documentation - packing slips, bills of lading, invoices, etc.

- A product is considered perfect if the product ordered is the product provided.
- A quantity is considered perfect if the product ordered is provided in the ordered quantity.
- A delivery is considered perfect if the location and delivery time ordered is met upon receipt.
- A customer is considered perfect if the product is delivered to the specified entity.
- Documentation supporting the order line is considered perfect if it is all accurate, complete, and on time.
- The product condition is considered perfect if the product is delivered / faultlessly installed (as applicable) according to specifications with no damage, customer ready, and is accepted by the customer. Faultlessly installed (as applicable), correct configuration, customer-ready, no damage, on specification

Calculation: [Total Perfect Orders] / [Total Number of Orders]

Discussion:

The performance of the supply chain is considered "perfect" if a commitment made to a customer is met through the supply chain. Level 1 is at the order level, Level 2 is the order line, and Level 3 is the components.

An order is defined as a collection of one or more order lines representing a request to deliver specified quantities of goods or to render specific services. The order can further be defined as a request (with a specific identifier as a reference) to deliver specified items or to render specific services with specific prices, dates, and quantities. Commitments are made to a customer at the order line level, where an order line is defined as a line representing a commitment on a sales order. An order line always references a product or service.

For an order to be considered perfect the following standards must be met:
- Delivered complete; all items on the order line are delivered in the quantities specified
- Delivered on time to customer's specified date, using the customer's definition of on-time delivery
- Documentation supporting the order including packing slips, bills of lading, invoices, quality certifications, etc., is complete and accurate
- Faultlessly installed (as applicable), correct configuration, customer-ready and accepted, no damage, on specification

Often for date and quantity issues (and occasionally product) a range rather than a strict value is used. This is acknowledged as a standard practice; in those situations the standard measured is considered to be met perfectly if the range specified is satisfied.

The term "customer-ready" for the perfect condition standard may imply a subjective component based on the customer's satisfaction. Although condition may not be as rigorously measured as time or quantity it should be considered as a component if available, especially since this attribute measures performance of the supply chain which is, of course, ultimately measured by its customers.

It should also be noted that a corresponding evaluation of suppliers' performances could be determined by extending these standards to each supplier's ability to source products.

Appendix A: Metrics

Data Collection:

Data for the components that are used to drive the calculation of supply chain performance are primarily taken from Deliver and impact Deliver Enable process elements. These are primarily associated with the original commitment (Customer Order Processing – D1.2, D 2.2, D3.3) and the satisfaction of that commitment (Receipt and Installation (as appropriate) – D1.11, D1.12, D2.10, D2.11, D3.9, D3.10). In addition, the documents necessary for support of the supply chain process should be scored across the set of Deliver process elements. The Enable Deliver Process Element - Assess Delivery Performance (ED.2) should be updated from metrics derived.

Metrics:

The Perfect Order Fulfillment calculation is based on the performance of each Level 3 component of the order line to be calculated (product, quantity, date, time, documentation, condition, and customer). For an order line to be perfect, all of the individual components must be perfect.

The calculation of line item perfect order line fulfillment is based on the Level 3 components:

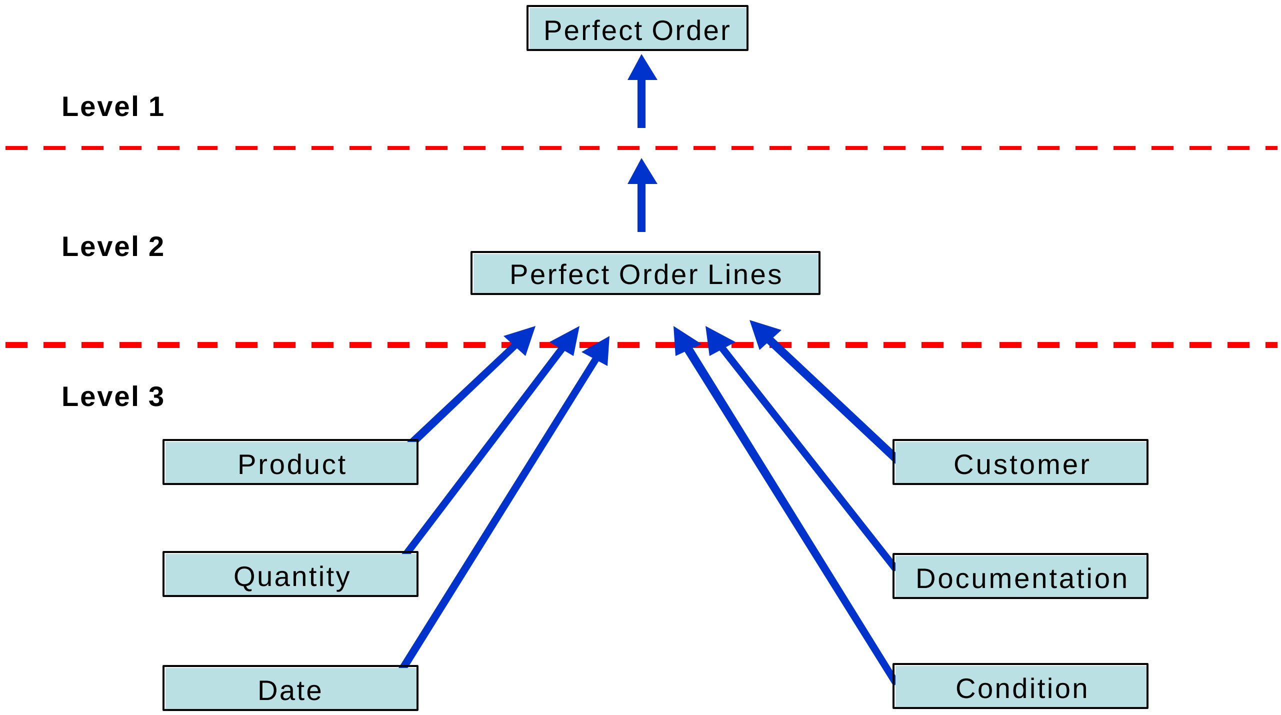
- Each component receives a score of 1 if it is judged to be perfect.
- It receives a score of 0 if not perfect.
- If the sum of the scores equal the number of components (in this case, 6) the order line is perfectly fulfilled.

The components required to calculate line item perfect order fulfillment are:

- A product is considered perfect if the product ordered is the product provided.
- A quantity is considered perfect if the product ordered is provided in the ordered quantity.
- A delivery is considered perfect if the location and delivery time ordered is met upon receipt.
- A customer is considered perfect if the product is delivered to the specified entity.
- Documentation supporting the order line is considered perfect if it is all accurate, complete, and on time.
- The product condition is considered perfect if the product is delivered / faultlessly installed (as applicable) according to specifications with no damage, customer ready, and is accepted by the customer. Faultlessly installed (as applicable), correct configuration, customer-ready, no damage, on specification

Perfect order lines may be summarized by order to provide a perfect order measurement. Consider the following chart and example.

Appendix A: Metrics



Benchmarking:
As is the case with benchmarking in general, comparisons can be made to a company's own prior performance as well as comparisons to other companies in similar (or different) industries. In the case of one's own previous performance, comparisons may be easily made, with the goal being a steady improvement in performance, often with a focus on strategic targets. In relation to other companies, comparisons can be made at both Level 1 and Level 2. In general, the lower the level of detail, the more valid the benchmarking comparison.

Economic Impact:

P&L ITEM	Metric contribution to the item listed
Sales	Y
COGS	Y
Gross Margin	Y
R&D	N
SG&A	Y
BALANCE SHEET ITEM	
Accounts Receivable	Y
Cash & Investments	Y
Inventory	Y
Fixed Assets	N
Other Assets	Y
Accounts Payable	Y
Other Current Liabilities	Y

Comments:
The case can be made that Reliability will become an even more important attribute of supply chain performance as companies become more adept at reconfiguration, delivery times reduce, and internal expenses become of less concern to the end customers.

Although not specifically addressed with this metric, the same techniques are readily transferable to suppliers and to internal replenishment orders.

Appendix A: Metrics

Level 1 Metric: Order Fulfillment Cycle Time

Definition: The average actual cycle time consistently achieved to fulfill customer orders. For each individual order, this cycle time starts from the order receipt and ends with customer acceptance of the order. Order Fulfillment Cycle Time consists of a 'gross' component and a 'net' component named Order Fulfillment Process Time, according to the following formula: Order Fulfillment Cycle Time = Order Fulfillment Process Time + Order Fulfillment Dwell Time. Order fulfillment process time approximates Order Fulfillment Lead Time (the minimum amount of time to fulfill a customer order in the absence of inventory)

Calculation: [Sum Actual Cycle Times For All Orders Delivered] / [Total Number Of Orders Delivered]

Discussion:

Responsiveness of a supply chain indicates the speed with which a supply chain can react to the demand from the customers (as represented by orders received from the customers) for existing products or services. Responsiveness captures the ability to deal with normal fluctuations in customer demand while fulfilling existing customer requirements, as opposed to the flexibility attribute that is more concerned with the agility of a supply chain in meeting new customer requirements or in meeting existing customer requirements in changed business conditions.

The responsiveness attribute of a supply chain can be used by companies to differentiate themselves from other supply chains in order to gain competitive advantage. In general a more responsive supply chain will lead to higher customer satisfaction and a better position in the market.

Data Collection:

Data for the components that are used to drive the calculation of responsiveness are taken from the Source, Make and Deliver process elements, depending on the possible strategies deployed by companies to fulfill orders such as make-to-stock, make-to-order or engineer-to-order.

Metrics:

The key metric to capture responsiveness is Order Fulfillment Cycle Time, defined as "the average actual cycle time consistently achieved to fulfill customer orders". For each individual order this cycle time starts from the order receipt and ends with customer acceptance of the order.

The word 'achieved' together with 'actual' cycle time is used to indicate that it is the cycle times as they have been experienced in reality by the customer, not the published (theoretical) lead time and not necessarily the promised / agreed lead time. 'Average' indicates that if the customer makes multiple orders of the same type, the average of the various cycle times achieved for each individual order will be taken. This also emphasizes that consistency is important.

Calculation is based on the following formula: [Sum Actual Cycle Times For All Orders Delivered] / [Total Number Of Orders Delivered]

Concept of dwell time

A further distinction needs to be made. The order fulfillment cycle time as captured from the moment a customer places the order to the moment the order is fulfilled is considered to be a 'gross' cycle time. It represents all the time passed between these two events, regardless of whether this represented cycle time for the activities performed by the organisation to fulfill the order (both value-add and non-value-add) or dwell time because the order was placed well in advance by the customer. As such, this gross order fulfillment cycle time does not truly reflect the responsiveness of the organisation. Take for example an organisation that needs six days to fulfill a certain customer order. If the customer places the order one day in advance, the gross order fulfillment cycle time will be seven days. If the customer places the order 3 months ahead (pre-ordering), the gross fulfillment cycle time will be 96 days. However, the fact that the customer pre-orders does not reduce the responsiveness of the organisation. On the contrary, one can argue that it may increase the ability of the organisation to meet that order as it allows the organisation to plan ahead and fulfill the order in a more optimal way.

Appendix A: Metrics

The responsiveness of the organisation is determined by the cumulative cycle time for all activities that are required to fulfill the order, but should exclude any dwell time where no activity takes place.

Therefore the definition of Order Fulfillment Cycle Time consists of a 'gross' component and a 'net' component named Order Fulfillment Process Time, according to the following formula: Order Fulfillment Cycle Time = Order Fulfillment Process Time + Order Fulfillment Dwell Time. Note that dwell time will equal 0 for companies who do not utilize this metric, so Order Fulfillment Cycle Time will equal Order Fulfillment Process Time.

Order fulfillment dwell time is defined as 'any lead time during the order fulfillment process where no activity takes place, which is imposed by customer requirements'. Note that this dwell time is different from 'idle time' or 'non-value-add lead time', which is caused by inefficiencies in the organization's processes and therefore ultimately under responsibility of the organisation. This kind of idle time should <u>not</u> be deducted from the gross order fulfillment cycle time.

Dwell time is mostly associated with the ordering process, where a customer may place an order in advance to reserve capacity/materials etc, but where the actual steps in the order fulfillment process take place later on. It is also common in the delivery process where the organisation may be in principle ready to ship the product/service, but is requested by the customer to wait (for example to follow a certain shipment schedule).
Note that for those organisations where dwell time does not play a role, the dwell time can be taken as zero days which results in the net order fulfillment cycle time to be equal to the gross order fulfillment cycle time

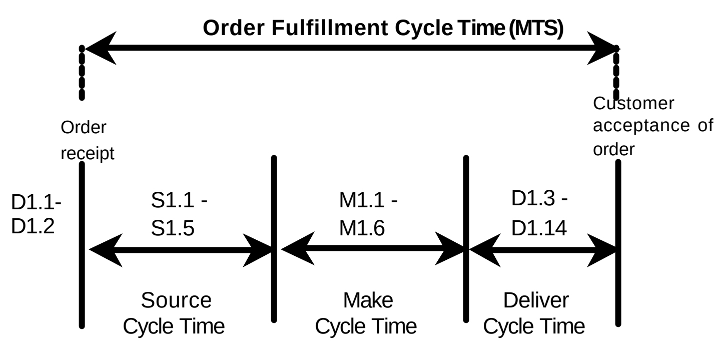
For benchmarking purposes it is recommended to use the Order Fulfillment Process Time, as this is the cycle time reflecting most accurately the responsiveness of the organisation. It will also ensure that those organisations in industries where dwell time is a factor can be benchmarked against organisations in industries where dwell time does not play a role.

The concept of dwell time applies not only to the level 1 metric, but also to all lower level metrics. This means that each lower level metric can have a gross component, consisting of the net component and dwell time. Because the lower level metrics are hierarchical (the cumulative sum of cycle times at level 2 or 3 should be equal to the cycle time at level 1), the cumulative sum of dwell times at level 2 or 3 should total up to the dwell time at level 1.

Drill-down to lower level metrics

Order fulfillment cycle time applies equally well to all possible strategies deployed by companies to fulfill orders, such as make-to-stock, make-to-order or engineer-to-order. However, note that the breakdown of this metric into lower level metrics will be different for each of these strategies.

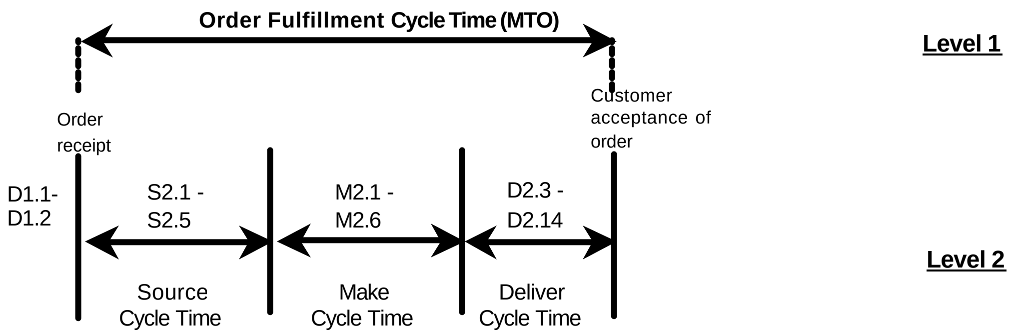
Drill-down to level 2 metrics

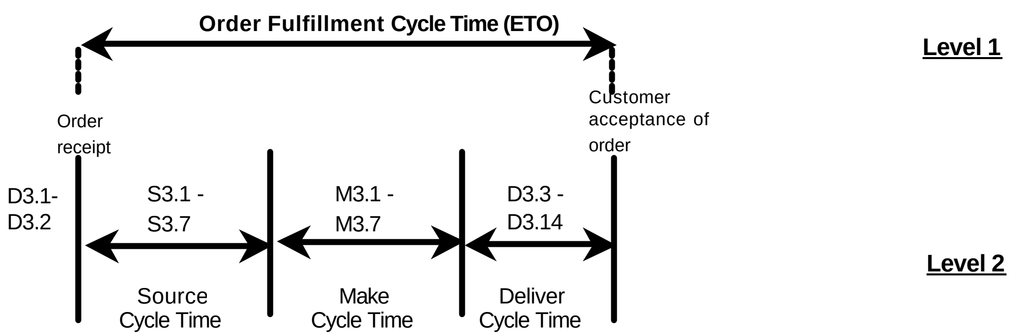


<u>Level 1</u>

<u>Level 2</u>

Appendix A: Metrics





Drill-down to level 3 metrics

Each level 3 process has its associated level 3 metric, which simply reflects the cycle time required to execute the level 3 processes. This means that both the level 1 metric order fulfillment cycle time and the level 2 metrics can be directly broken down into level 3 metrics.

Benchmarking:

As is the case with benchmarking in general, comparisons can be made to a company's own prior performance as well as comparisons to other companies in similar (or different) industries. In the case of one's own previous performance, comparisons may be easily made, with the goal being a steady improvement in performance, often with a focus on strategic targets. Use of the Order Fulfillment Process Time for benchmarking is the cycle time reflecting most accurately the responsiveness of the organisation. It will also ensure that those organisations in industries where dwell time is a factor can be benchmarked against organisations in industries where dwell time does not play a role.

Best Practices:

Best practices within the supply chain that affect Responsiveness include:

- Real time data visibility and accuracy
- Available to Promise calculation
- Postponement strategies

Appendix A: Metrics

Economic Impact:	
P&L ITEM	**Metric contribution to the item listed**
Sales	**Y**
COGS	**Y**
Gross Margin	**Y**
R&D	**N**
SG&A	**Y**
BALANCE SHEET ITEM	
Accounts Receivable	**Y**
Cash & Investments	**N**
Inventory	**Y**
Fixed Assets	**N**
Other Assets	**N**
Accounts Payable	**N**
Other Current Liabilities	**N**

Level 1 Metric: Upside Supply Chain Flexibility

Definition: The number of days required to achieve an unplanned sustainable 20% increase in quantities delivered.

Calculation: The calculation of supply chain flexibility requires the calculation to be the least time required to achieve the unplanned sustainable increase when considering Source, Make, and Deliver components.

Metrics

Upside Supply Chain Flexibility = The number of days required to achieve an unplanned sustainable 20% increase in quantities delivered.

The calculation of supply chain flexibility requires the calculation to be the least time required to achieve the unplanned sustainable increase when considering Source, Make, and Deliver components. For example, if it requires 90 days achieve a 20% increase in raw material volume, 60 days for adding capital to support production, and no time to increase the ability to deliver, upside supply chain flexibility would be 90 days (if production changes can run concurrently with material acquisition activities) or as much as 150 days if production changes and material acquisition changes must run sequentially.

Components:

Upside Source Flexibility: The number of days required to achieve an unplanned sustainable 20% increase in quantity of raw materials.

Upside Make Flexibility: The number of days required to achieve an unplanned sustainable 20% increase in production with the assumption of no other constraints.

Upside Deliver Flexibility: The number of days required to achieve an unplanned sustainable 20% increase in quantity delivered with the assumption of no other constraints.

Upside Source Return Flexibility: The number of days required to achieve an unplanned sustainable 20% increase in the return of raw materials to suppliers. Upside Deliver Return Flexibility: The number of days required to achieve an unplanned sustainable 20% increase in the return of finished goods from customers.

Discussion

Certainly enterprises deal with change all the time. In most cases, these changes are minor deviations from the "norm" or fleeting "blips" in the marketplace. Also, certainly, most supply chains move through these changes almost effortlessly and, in this regard, demonstrate equivalent flexibility. In many extreme cases, however, it is possible that a particular supply chain has reached a condition of relative rigidity (say, at capacity or rigid, constraining agreements with partners) and a seemingly minor increase in production requirement can consume much time and effort as the supply chain struggles to restore its capability to perform.

It is evidenced that enterprises engaged in appropriate business risk and competitive contingency planning activities will usually be in a better position to optimize overall supply chain performance and these activities are presented as best practices later in this document.

When change is known in advance (such as Wal-Mart requiring RFID devices on all delivered cases, or a major sourcing change is planned to occur), and is incorporated in the enterprise's operating plan, then the time incurred to undertake the adaptation isn't necessarily a reflection of the supply chain's flexibility. While flexibility is still addressed, it is frequently clouded by other considerations in the operating plan. Unplanned change is the primary consideration in measuring the supply chain's flexibility.

Appendix A: Metrics

Data Collection:

Data for the components that are used to drive the calculation of supply chain flexibility are taken from the actual planning activities incurred in devising the actions to be taken and the execution activities themselves. Neither the complete set of activities nor any given subset of those activities can be identified except in either contingency plans (in which case they are hypothetical), special analytical simulations conducted for the purpose of predicting total elapsed time, or after the fact (when they have actually occurred and are unlikely to reoccur in the same combination).

Level 1 Metric: Upside Supply Chain Adaptability

Definition: The maximum sustainable percentage increase in quantity delivered that can be achieved in 30 days.

Calculation: The calculation of supply chain adaptability requires the calculation to be the least sustainable quantity that can be achieved when considering Source, Make, and Deliver components.

Metrics

Upside Supply Chain Adaptability = The maximum sustainable percentage increase in quantity delivered that can be achieved in 30 days.

Components:

Upside Source Adaptability: The maximum sustainable percentage increase in raw material quantities that can be acquired/received in 30 days.

Upside Make Adaptability: The maximum sustainable percentage increase in production that can be achieved in 30 days with the assumption of no other constraints.

Upside Deliver Adaptability: The maximum sustainable percentage increase in quantities delivered that can be achieved in 30 days with the assumption of no other constraints.

Upside Source Return Adaptability: The maximum sustainable percentage increase in returns of raw materials to suppliers that can be achieved in 30 days with the assumption of unconstrained finished goods availability. Upside Deliver Return Adaptability: The maximum sustainable percentage increase in returns of finished goods from customers that can be achieved in 30 days.

Level 1 Metric: Downside Supply Chain Adaptability

Definition: The reduction in quantities ordered sustainable at 30 days prior to delivery with no inventory or cost penalties.

Calculation: The calculation of supply chain adaptability requires the calculation to be the least sustainable quantity that can be achieved when considering Source, Make, and Deliver components.

Metrics

Downside Supply Chain Adaptability = The reduction in quantities ordered sustainable at 30 days prior to delivery with no inventory or cost penalties.

Components:

Downside Source Adaptability: The raw material quantity reduction sustainable at 30 days prior to delivery with no inventory or cost penalties.

Downside Make Adaptability: The production reduction sustainable at 30 days prior to delivery with no inventory or cost penalties.

Downside Deliver Adaptability: The reduction in delivered quantities sustainable at 30 days prior to delivery with no inventory or cost penalties.

Level 1 Metric: Supply Chain Management Cost

Definition: All direct and indirect expenses associated with operating SCOR business processes across the supply chain.

Calculation: Sum of the Cost to (strategize and) Plan, Cost to Source, Cost to Deliver, and the Cost to Return

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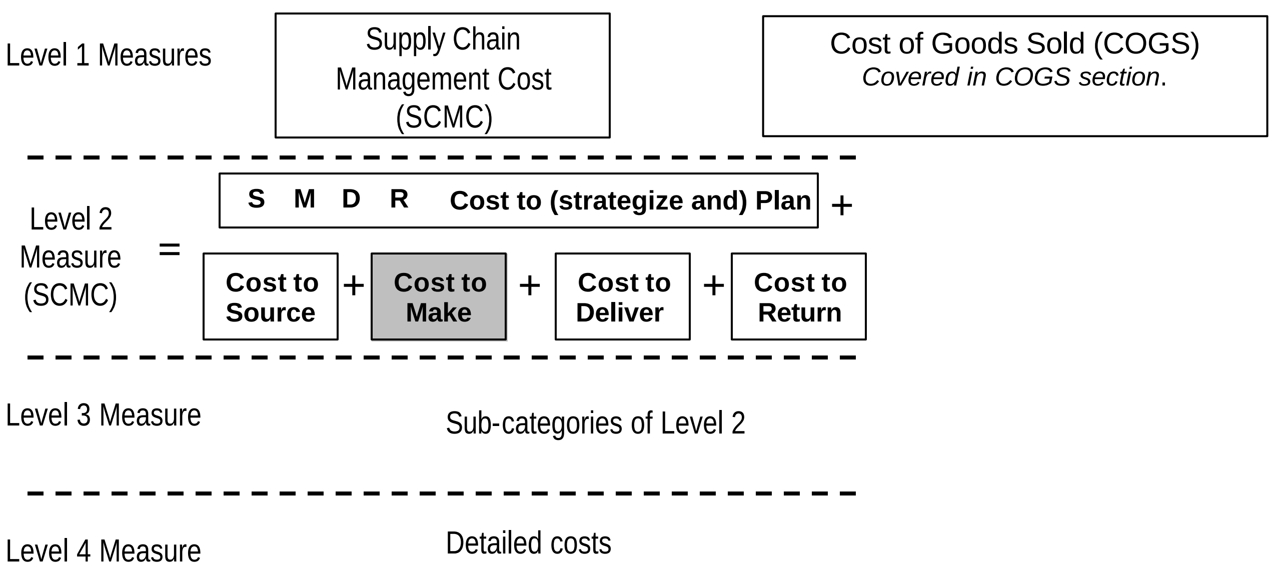
Definition of Cost:

All direct and indirect expenses associated with operating SCOR business processes across the supply chain.

Discussion:

The Supply Chain Management Cost (SCMC) and Cost of Goods Sold (COGS) may be an enterprise's total expenses (sales – profits) if you take the broadest view that all of its spending serves its performance in the chain. However, for the current SCOR version the scope would be:



The Cost to Make is captured in Cost of Goods Sold (COGS), however there can be overlap between COGS and SCMC, so watch carefully for the possibility of double counting. To find some costs in Make, both COGS and SCMC are needed. Enabling costs (such as IT) and inventory carrying costs are allocated to the process that they support. For example, the costs associated with a purchasing system would be allocated to Cost to Source and the costs associated with an order management system would be allocated to Cost to Deliver. The carrying costs associated with raw material would be associated with Cost to Source and finished goods to Cost to Deliver.

Appendix A: Metrics

The Levels 1, 2, and 3 are common sense to executives. Levels 4 and below are cost data that any CFO or controller should easily be able to trace and assign (i.e., allocate) from their general ledger cost center accounting system.

Level 2 is SCOR's Plan, Source, Make, Deliver, and Return.
Level 3 are sub-categories of level 2.
Level 4 cost components (and below) is where comparative ratios, percentages, benchmarks, etc. are reported to foster focusing and decision analysis.

The appeal of this current cost framework is that it exactly mirrors SCOR.

In future versions, subject to approval, three additional Level 2 cost components would be added to make SCOR's scope enterprise-wide. This full scope would represent an organization's entire spending, and thus SCOR costs would exactly reconcile with an organization's profit and loss statement. CEOs and executive teams feel great comfort when reported financial numbers they view sum to their financial accounting statements. The three additional future cost components would be:

- *cost to serve (e.g., customer service, sales calls, dispute handling)*
- *cost to acquire (e.g., marketing campaigns)*
- *cost to sustain the business (e.g., legal, personnel, R&D, corporate administration)*

The inclusion of the "cost to serve" and "cost to acquire" will position SCOR to integrate with customer-centric strategies and methods (e.g.,. customer relationship management [CRM] and marketing campaign automation) that are being forced onto all companies, unless it is a monopoly. These forces are:

- *Total customer profitability must be known (below the P&L's gross profit line) to distinguish high from low maintenance customers.*
- *The costs to acquire (market to) new customers is substantially greater than to retain existing ones.*
- *As products become more commodity like, the source of competitive advantage shifts from product differentiation to value-added services differentiation.*
- *The Internet is irreversibly shifting power from suppliers to buyers (i.e., customers). Suppliers' pricing and product shopping information is more readily accessible to buyers.*

LEVEL 3 CONTAINS SUB-CATEGORIES of LEVEL 2:

- Cost to source (supplier management, material acquisition management [order-related transactions]
- Cost to make (direct material expenses, direct non-material expenses, direct labor expenses, indirect non-material expenses)
- Cost to deliver (sales order management [order-related transactions], customer management)
- Cost to return (return to source, return to customer)
- Cost to plan (includes planning activities in the above 4)

Level 4 is where the metrics reside. (see Metrics below.)

Data Collection:

Unlike the other SCOR attributes, where data requirements are specified, typically all of a costing system's source data is already captured by business operating systems:

- general ledger cost center expenses
- purchasing systems
- labor reporting systems
- production reporting systems

As a result, cost information is 'calculated' by importing data from these systems and transforming them into cost information. The transformation is accomplished using business rules (e.g. indirect cost allocations).

Appendix A: Metrics

Metrics:

Supply Chain Management Cost (SCMC) is a Level 1 discrete measure defined as the operational costs associated with the Level 2 costs of Plan, Source, Deliver, and Return supply chain processes. This process view of supply chain costs takes into account Level 3 costs that are aggregates of Level 4 costs. Examples of these processes are:

- sales order management (Deliver),
- material acquisition management (Source),
- direct product (Make),
- cost to return to supplier (Return)

The Levels 2 and 3 logic is based on the presumption that SCMC metrics segment the organizational cost centers (from the general ledger accounting system) into a cross-department process-based view of costs. A method to accomplish this to map the cost centers (with their period expenses) at Level 4 and cross-reference them to roll-up into the Level 3 "process" costs, such as the examples above.

Benchmarking:

As is the case with benchmarking in general, comparisons can be made to a company's own prior performance as well as comparisons to other companies in similar (or different) industries. In the case of one's own previous performance, comparisons may be easily made, with the goal being a steady improvement in performance, often with a focus on strategic targets. In general, the lower the level of detail (e.g., level 4), the more valid the benchmarking comparison.

Best Practices:

Best practices within the supply chain that affect COST include:

- Reasonably detailed cost center and expense transaction accumulations in the general ledger accounting system
- Labor reporting
- Production (work volume output) reporting
- Cost allocations based on "factors" with cause-and-effect relationships (correlation) rather than broad-brushed averages
- A flexible multi-stage cost assignment modeling technology

Economic Impact:

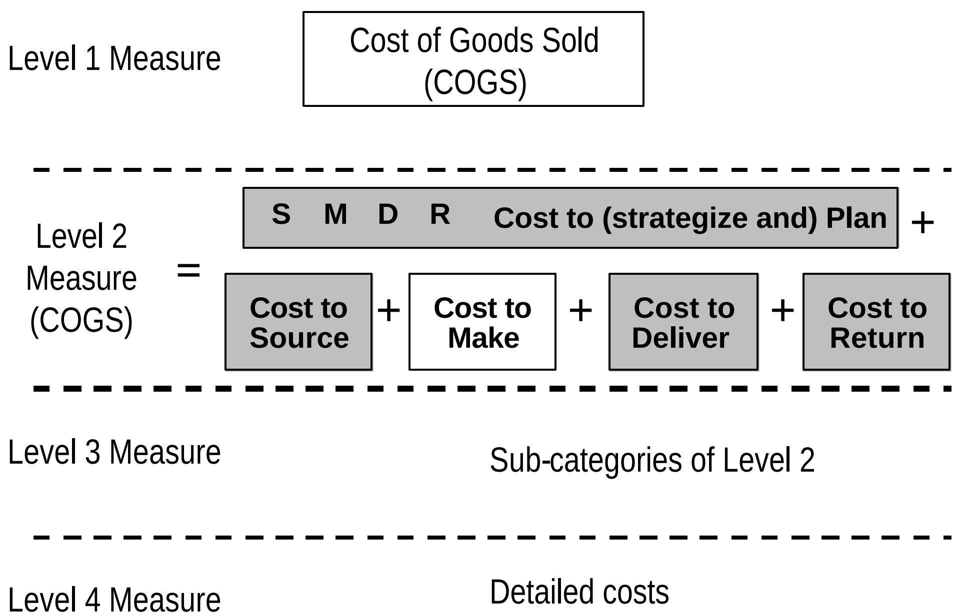
P&L ITEM	Metric contribution to the item listed
Sales	Y
COGS	Y
Gross Margin	Y
R&D	Y
SG&A	Y
BALANCE SHEET ITEM	
Accounts Receivable	Y
Cash & Investments	Y
Inventory	Y
Fixed Assets	Y
Other Assets	Y
Accounts Payable	Y
Other Current Liabilities	Y

Level 1 Metric: Cost of Goods Sold

Definition: The cost associated with buying raw materials and producing finished goods. This cost includes direct costs (labor, materials) and indirect costs (overhead).

Calculation: Direct Material + Direct Labor + Overhead

Metrics



The Cost to (strategize and) Plan, Cost to Source, Cost to Deliver, and the Cost to Return is captured in Supply Chain Management Cost (SCMC), however there can be overlap between COGS and SCMC, so watch carefully for the possibility of double counting. To find some costs in Make, both COGS and SCMC are needed.

The Levels 1, 2, and 3 are common sense to executives. Levels 4 and below are cost data that any CFO or controller should easily be able to trace and assign (i.e., allocate) from their general ledger cost center accounting system.

Level 2 is SCOR's Plan, Source, Make, Deliver, and Return.
Level 3 are sub-categories of level 2.
Level 4 cost components (and below) is where comparative ratios, percentages, benchmarks, etc. are reported to foster focusing and decision analysis.

The appeal of this current cost framework is that it exactly mirrors SCOR.

Appendix A: Metrics

Level 1 Metric: Cash-to-Cash Cycle Time

Definition: The time it takes for an investment made to flow back into a company after it has been spent for raw materials.

Calculation: Inventory Days of Supply + Days Sales Outstanding – Days Payable Outstanding

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Definition:

The time it takes for an investment made to flow back into a company after it has been spent for raw materials. For services, this represents the time from the point where a company pays for the resources consumed in the performance of a service to the time that the company received payment from the customer for those services.

Discussion:

Cash-to-cash Cycle Time is a value metric used to measure how efficiently a company manages its working capital assets.

This metric is a generally accepted Supply Chain metric within many industries and is used to benchmark supply chain asset management performance.

This only change to this metric is to clarify the use of the "5 point annual average" approach. This approach was not used consistently in the current SCOR v5.0 definition. It is used in the definition of one of the components (Days Sales Outstanding), but not in the other two components (Inventory Days of Supply, Average Payment Period for Materials). The "5 point annual average" approach should be added to the three Level 2 metric definitions.

The term "5 point annual average" can be confusing in that it can imply a measure over a year's period of time when the data points are taken over 5 quarters. The intent of the approach is to smooth the seasonal peaks and valleys over time and to balance projected data with historical data. Recommended to change the term to "5 point rolling average" as this implies that the measurement can be taken quarterly and at any given time.

The current definition includes the component Average Payment Period for Materials. This is not currently a SCOR metric.

This metric now includes Inventory Days of Supply at Level 2, which was a Level 1 metric in past versions of SCOR.

Metrics

Level 2 Metrics

Inventory Days of Supply = the amount of inventory (stock) expressed in days of sales. The [5 point rolling average of gross value of inventory at standard cost] / [annual cost of goods sold (COGS) / 365]
Example: If 2 items a day are sold and 20 items are held in inventory, this represents 10 days' (20/2) sales in inventory.
(Other names: Days cost-of-sales in inventory, Days' sales in inventory)

Days Sales Outstanding = the length of time from when a sale is made until cash for it is received from customers. The amount of sales outstanding expressed in days. The [5 point rolling average of gross accounts receivable (AR)] / [total gross annual sales / 365].
Example: If $5000 worth of sales were made per day and $50,000 worth of sales were outstanding, this would represent 10 days' ($50,000/$5000) of sales outstanding.
(Other names: Days sales in Accounts receivables)

Appendix A: Metrics

Days Payable Outstanding = the length of time from purchasing materials, labor and/or conversion resources until cash payments must be made expressed in days. The [5 point rolling average of gross accounts payable (AP)] / [total gross annual material purchases / 365].
(Other names: Average payment period for materials, Days purchases in accounts payable, Days' outstanding in accounts payable)

The "5 point rolling average" calculation uses a combination of both historical and forward-looking data. This means that the rolling average value has to be calculated based on the average over the four previous quarters and the projection for the current or next quarter.

The 5 point rolling average calculation is:
[Sum of the 4 previous quarters + projection for next quarter) / 5]

Economic Impact

The longer the cash-to-cash cycle, the more current assets needed (relative to current liabilities) since it takes longer to convert inventories and receivables into cash. In other words, the longer the cash-to-cash cycle, the more net working capital required.

P&L ITEM	Metric contribution to the item listed
Sales	N
COGS	N
Gross Margin	N
R&D	N
SG&A	N
BALANCE SHEET ITEM	N
Accounts Receivable	Y
Cash & Investments	Y
Inventory	Y
Fixed Assets	N
Other Assets	N
S/T Investment	N
Accounts Payable	Y
Other Current Liabilities	N

Level 1 Metric: Return on Supply Chain Fixed Assets

Definition: Measures the return an organization receives on its invested capital in supply chain fixed assets. This includes the fixed assets used in Plan, Source, Make, Deliver, and Return.

Calculation: (Supply Chain Revenue – COGS – Supply Chain Management Costs) / Supply-Chain Fixed Assets

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Definition:

Return on Supply Chain Fixed Assets measures the return an organization receives on its invested capital in supply chain fixed assets. This includes the fixed assets used in Plan, Source, Make, Deliver, and Return.

Discussion:

Range of fixed assets used in an organization that have the character of permanency rather than being rapidly replaced (or expensed); examples include land, warehouse, trucks, buildings, investments, and plant and machinery.

Fixed assets used to operate the Supply Chain in each of the categories (P, S, M, D, R) are tracked within the Ex.5 process elements. A Revised Capital Plan is an output of the Manage Integrated Supply Chain Fixed Assets (EP.5) process element and would contain supply chain capital asset information that could be used in measuring the Supply Chain Fixed Asset Value.

This metric replaces Asset Turns that was a Level 1 metric in past versions of SCOR.

Data Collection:

In order to measure Return on Supply Chain Fixed Assets, the investment in supply chain capital assets needs to be known. This requires a clear understanding of what is a "supply chain fixed asset". SCOR Ex.5 process elements were used since these are all focused on managing SC capital assets. It is the assets managed in these Enable processes that comprise Supply Chain Fixed Assets. The value of these assets is the denominator of the metric.

Metrics:

"Supply Chain Revenue" is used in the metric rather than just Net Revenue. SC Revenue is calculated as: Supply Chain Revenue - COGS - Total Supply Chain Management Costs. This provides the revenue generated through the supply chain less the total costs associated with the supply chain.

There is a need for a more specific "revenue" number than "Net Revenue" for use in the "Supply Chain Revenue" level 2 metric. Net Revenue could include revenue from sources other than the supply chain, such as investments, leasing real estate, court settlements, etc... Supply Chain Revenue will be used and will be only the portion of Net Revenue that is generated by the specific supply chain being measured and analyzed.

Appendix A: Metrics

Level 2 Metrics

Supply-Chain Revenue

Operating revenue generated from a supply chain. This does not include non-operating revenue, such as leasing real estate, investments, court settlements, sale of office buildings, etc...

COGS

Calculation - Refer to the section for COGS in the Attribute for Costs.

Supply Chain Management Costs

Calculation - refer to the section for Supply-Chain Management Costs in the Attribute for Costs.

Supply Chain Fixed Assets

Source Fixed Asset Value +
Make Fixed Asset Value +
Deliver Fixed Asset Value +
Return Fixed Asset Value +
Plan Fixed Asset Value

Level 3 Metrics

Plan Fixed Asset - The current value of the supply chain assets used in supply chain integration (See EP.5)
Source Fixed Asset - The current value of the supply chain assets used in the Source process. (See ES.5)
Make Fixed Asset - The current value of the supply chain assets used in the Make process. (See EM.5)
Deliver Fixed Asset - The current value of the supply chain assets used in the Deliver process. (See ED.5)
Return Fixed Asset - The current value of the supply chain assets used in the Return process. (See ER.5)
A Revised Capital Plan is an output of the Manage Integrated Supply Chain Fixed Assets (EP.5) process element and would contain supply chain capital asset information that could be used in measuring the Supply Chain Fixed Assets.

Benchmarking:

As is the case with benchmarking in general, comparisons can be made to a company's own prior performance as well as comparisons to other companies in similar (or different) industries. In the case of one's own previous performance, comparisons may be easily made, with the goal being a steady improvement in performance, often with a focus on strategic targets. In relation to other companies, comparisons can be made at Level 1, Level 2 and Level 3.

Best Practices:

There are numerous best practices within the respective domains of the supply chain (Plan, Source, Make, Deliver and Return) that impact the Return on Supply-Chain Assets. Any best practice which would influence the components of the P&L accounts of Sales, COGS and SG&A and/or components of the Balance Sheet accounts of Fixed Assets should be considered when determining methods to improve the measured performance of this metric.

Appendix A: Metrics

Economic Impact:

P&L ITEM	Metric contribution to the item listed
Sales	Y
COGS	Y
Gross Margin	N
R&D	N
SG&A	Y
BALANCE SHEET ITEM	
Accounts Receivable	N
Cash & Investments	N
Inventory	N
Fixed Assets	Y
Other Assets	N
Accounts Payable	N
Other Current Liabilities	N

APPENDIX B – Best Practices

APPENDIX B
Best Practices

Background Development Information
2004 Best Practices Project Team

- **Assess Supplier Performance**
- **Collaborative Planning, Forecasting, Replenishment (CPFR)**
- **Co-Located Procurement Representatives**
- **Cross-Docking**
- **Drum – Buffer – Rope Scheduling Technique**
- **Environmental Performance Indicator module (EPI module)**
- **Inventory Cycle Counting**
- **Merge-In-Transit**
- **Sales and Operations Planning**
- **Supplier (Carrier) Agreements**
- **Vendor Managed Inventory (VMI)**
- **Wave Picking**

Definition of a Best Practice

A current, structured, proven and repeatable method for making a positive impact on desired operational results.

- **Current -** Must Not be emerging (bleeding edge) and must NOT be antiquated
- **Structured -** Has clearly stated Goal, Scope, Process, and Procedure
- **Proven** - Success has been demonstrated in a working environment.
- **Repeatable -** The practice has been proven in multiple environments
- **Method -** Used in a very broad sense to indicate: business process, practice, organizational strategy, enabling technology, business relationship, business model, as well as information or knowledge management.
- **Positive impact on desired operational results.** - The practice shows operational improvement related to the stated goal and could be linked to Key Metric(s). The impact should show ether as gain (increase in speed, revenues, quality) or reduction (resource utilizations, costs, loss, returns, etc.).

(Defined by SCC Best Practices Team, 2003)

Appendix B

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Appendix B: Best Practices

Best Practice: Access Supplier Performance

SCOR Process Number: ES.2
SCOR Process Name: Assess Supplier Performance

Unique Best Practice Title: Assess Supplier Performance

BEST PRACTICE Need Indicators:

- Improvement of Supplier Performance
- Reliability in material delivery
- Need to reduce numbers of suppliers

BEST PRACTICE Description:
The process of measuring actual supplier performance against internal and/or external standards, providing feedback to achieve and maintain the performance required to meet the customers' business and/or competitive needs.

The supplier management program at a representative company has 6 elements:

1. Viability of supplier – Financial credit rating via D & B, Risk rating associate with overall financial health.
2. Supplier Capability – Quality of supplier deliveries in PPM for Engineering programs and Production parts
3. Dependability – On time delivery for Engineering programs and Production deliveries, number of stock outs, average days of stock out
4. Responsiveness – Part lead time, inventory turns
5. Competitiveness – YTD part cost savings, number of parts on pull processes (JIT), electronic data exchange
6. Technical ability – Global reach, Engineering ability, Technology roadmaps

Each month, the source data is extracted from ERP for each supplier. A report card is created and communicated to suppliers. Performance data is monitored by commodity manager with expectation that supplier responds to any variance to goals or expected results.

This supplier performance data can be used to select suppliers for a preferred supplier program. Preferred suppliers are given preference for all new business awards and supporting Engineering development programs.

Appendix B: Best Practices

Affected Supply Chain Performance Attributes/Metrics:

Attribute	Experienced Impact
Reliability	Source data is from transactions logged in ERP system. No arguments concerning their data vs. our data. Variance to goals is trigger for supplier to present corrective actions. Supplier and customer can focus on performance vs. data integrity. Detail data on delivery and quality are used to identify chronic performance issues for improvement.
Flexibility	Since new business is awarded to suppliers that perform, good suppliers are in a continuous improvement mode.
Responsiveness	Improve reaction time for demand inside of lead-time. Mind share is maintained due to monthly performance scorecard. Very important for New Product development deliveries.
Costs	Not an event, but expected throughout the year.
Asset Management	Suppliers are encouraged to improve inventory turns by implementing pull systems for their parts.

Appendix B: Best Practices

Key BEST PRACTICE Success Factors/Implementation Issues:

KSF	Comments
Technology	A data warehouse may need to be created with data extracted from ERP source system. Electronic exchange of reports and data is useful. Web portals, email, fax, mail could all be used to communicate supplier data. Data mining (self servicing) by supplier on their performance data is an example of advanced supplier management processes.
Policies/Procedures	Key documented policies include – Supplier Management Process, Supplier Survey and Evaluation process, and Supplier Performance Measurement process. Creates a framework that enables focused energy on the critical preferred suppliers.
Training/Education	Roll out of process, methodology, terms, source of data, frequency, and variance expectation needs to be communicated to all suppliers on the program. This also needs to be communicated to key stakeholders in the company such as buyers and engineers.
Sponsors	VP of Operations (Manufacturing, Supply Chain, Logistics) Need support from Component Engineering and New Product Development organizations. Executive sponsorship is essential.
Shared Vision	Key policies and methodologies are shared with all internal employees via the company Intranet. External supplier communication is accomplished by commodity managers via supplier reviews.
Measures/Milestones/ Feedback	Monthly 'report card' showing compliance with established expectations. Variances require corrective action. Twelve month rolling trend report for key metrics are used to track overall supply base performance and identify areas for improvement at the commodity and/or part number level.
Rewards/Recognition	Formal recognition of Preferred Supplier status via award given by VP of Manufacturing. The best suppliers get first opportunity to bid on new business. Share benefits derived from superior performance
Guidance Structure and Process	Infrastructure needs to be robust. Data accuracy is a requirement. Focused resources and disciplined supplier management must be an organizational priority.
Quick Wins/Local Innovations	Eliminated discussion on data and shifted energies to improving performance. What gets measured gets results.
Communications/Best Practice Exchange	Process was developed for the Headquarters site. This process is expanding to other Global sites to support Global leverage of supply base.

Additional Comments
Suppliers are external extension of our Manufacturing Process. In today's competitive environment, our processes rely on dependable supply streams that react quickly to variability in demand.

Profile of Company where this BEST PRACTICE is most applicable:
This is a company-specific best practice that may apply to any manufacturing company that buys significant production material.

Appendix B: Best Practices

Best Practice: **Collaborative Planning, Forecasting, Replenishment (CPFR)â**
SCOR Process Number: P1
SCOR Process Name: Plan Supply Chain

Unique Best Practice Title: CPFR, Collaborative Planning, Forecasting, Replenishment

BEST PRACTICE Need Indicators:

- Improvement of demand forecasting throughout entire supply chain enterprise.
- Optimization of replenishment fill
- Improvements in supply chain short and long term planning and optimization

BEST PRACTICE Description:
CPFR is an industry standard sponsored by VICS, the Voluntary Interindustry Standards body and the Uniform Code Council, UCC. The standard as also been adopted by the Global Commerce Initiative, GCI.

CPFR is a series of nine-step business process guidelines supported by collaborative technology.
Develop Front end arrangement
Create Joint Business Plan
Create Sales Forecast
Identify Exceptions for sales forecast
Resolve/collaborate on exception items
Create Order Forecast
Identify Exceptions for order forecast
Resolve/collaborate on exception items
Order Generation

Affected Supply Chain Performance Attributes/Metrics: (Data Source: AMR Research)

Attribute	Experienced Impact	
Reliability	Better Store in stock Better customer service	2% – 8% 2% - 8%
Flexibility	Forecast improvement	20% - 40%
Responsiveness	Faster Replenishment Cycle Times	12% - 30%
Costs	Lower Logistics Cost	3% - 4%
Asset Management	Inventory Reduction	10% - 40% (AMR)

Comments:
www.globalscorecard.net : **The Global Scorecard.** This site provides a Capability Assessment Tool designed to give you a detailed understanding of your ECR (Efficient Consumer Response) capability and highlight specific improvement opportunities for your company. ECR was an early foundation for CPFR.

Improved forecasting capability allows for proactive planning and less reactive execution.

CPFR allows for enterprise wide supply chain visibility of raw material procurement through manufacturing processing, to transportation optimization, and finally consumer consumption.

CPFR® is a Registered Trademark of the Voluntary Interindustry Commerce Standards (VICS) Association

Appendix B: Best Practices

Key BEST PRACTICE Success Factors/Implementation Issues:

KSF	Comments
Technology	VICS CPFR interoperability technology standards documented and published by the CPFR Working Group. Standards support EDI 830, EDI 852, and XML Interoperability. Standards published for data modeling.
Policies/Procedures	Collaborative Planning Forecasting and Replenishment Voluntary Guidelines
Training/Education	Quarterly VICS CPFR Working Groups Universities Software providers Consulting firms
Sponsors	Voluntary Interindustry Commerce Standards – VICS Uniform Code Council – UCC Global Commerce Initiative - GCI
Shared Vision	RosettaNet – Hi Tech Industry DAMA – Apparel Industry CFRAME – Supply Chain Council
Measures/Milestones /Feedback	Successful CPFR pilot implementation CPFR 9 Steps executed based on company and trading partners capability and maturity within the supply chain Scalable production roll outs with multiple trading partners and products Published pilot results provided by AMR Research - Better Store in stock 2% – 8% - Sales increase 5% - 20% - Inventory Reduction 10% - 40% - Lower Logistics cost 3% - 4% - Faster replenishment cycle times 12% - 30% - Better customer service 2% - 8%
Rewards/Recognition	Multiple industry publications from leading magazines: Fortune, Supply Chain Management Review, Wall Street Journal
Guidance Structure and Process	VICS CPFR Working Group. Approximately 200 active companies membership.
Quick Wins/Local Innovations	Has been an industry standard since 1998. Adopted by major retailers and suppliers globally. Is currently being adopted by industries such as Tele Communications, Hi Tech, and DoD.
Communications/Best Practice Exchange	www.cpfr.org is the official website for the VICS CPFR Working group. This site contains multiple publications on CPFR as well as the actual CPFR process mapping guidelines, data model formats, and CPFR presentations.

Comments:
AMR Research – Janet Suleski, “Beyond CPFR: Retail Collaboration Comes of Age”, April 1, 2001

CPFR can be used in all industries and sectors of a supply chain.

The CPFR 9 steps are “guidelines” that should be adjusted to fit the specific trading partner relationship and capability. CPFR is considered 80% business process that is supported by technology standards for business-to-business interoperability. Many successful CPFR implementations have used limited technology and in some cases, no technology, during the pilot phase. Technology will become more of a requirement when the processed is scaled to production and with multiple trading partners.

Appendix B: Best Practices

Profile of Company where this BEST PRACTICE is most applicable:

CPFR has primarily been adopted by the retail and consumer package goods industry. Wal-Mart was the founding company of the process and recently announced adoption by 1,200 of its suppliers. The process has also been adopted by the grocery industry as well as the chain drug store industry.

Companies that heavily rely on demand forecast accuracy and high volume replenishment are primary beneficiaries of standard.

The original concepts of CPFR were derived from MRPII and DRP principals supported by Sales and Operations planning.

CPFR Guidelines were developed so they could be used by any industry and at all levels of the supply chain. They are also considered as "Guidelines" for trading partner collaboration, which should be tailored specially for the industry and company readiness and maturity.

Additional Comments:

CPFR standard guidelines were created to be utilized by any industry for supply chain process improvement. The Drummond Group on CPFR interoperability has certified technology companies. You can see the certification test results at: www.drummondgroup.com

Appendix B: Best Practices

Best Practice: Co-Located Procurement Representatives

SCOR Process Number: P1
SCOR Process Name: Plan Supply Chain

Unique Best Practice Title: Co-located Procurement Representatives

BEST PRACTICE Need Indicators:

- Delivery Reliability
- Inventory Coordination and Scheduling
- Product Innovation
- Total Cost of Ownership
- Expertise in Commodity / Local Culture & Practices
- Product Specifications and Quality Control (Increase in Variability)
- Lack of Supplier Relationship Integration (Local Optimization Realization)

BEST PRACTICE Definition/Description:
Regionalized Procurement Representatives are positioned in local markets to support corporate / procurement goals. Companies realize support is needed when cost and delivery objectives are not consistent with organizational goals. This leading practice involves identifying local procurement personnel to assist in creating a supply base to meet internal and external product requirements. These local representatives will perform all procurement related activities for the organization. Co-located procurement personnel bring the knowledge of the local supply base, understand their organizations demand and supply signals, and communication capability to work with company global commodity leadership.

Affected Supply Chain Performance Attributes/Metrics:
Comments:
For companies expanding their sourcing scope and distance, having personnel local to the market is a crucial element to maintaining supply chain performance. Local personnel are used to support the understanding of the demand and supply signals, production and logistics decisions. Companies that have sourced globally, but have not added local resources find challenges that diminish supply chain response time. Listed are some of the major factors: 1.) Communication (time, language, cultural) 2.) Lead time, 3.) Hidden Costs (taxes, tariffs, etc.), 4.) Quality Returns and Repairs, 5.) Political and Geography Risks, 6.) Units of Measure.

Cost is the huge driver in this Best Practice. For example, decisions affecting the supply chain can be made more accurately and in a timelier manner by experts in the field who can experience the day-to-day activities.

Attribute	Experienced Impact
Reliability	Improved Supply Chain Response Time Increase Order Fill Rates Reduction in Product Lead-Time
Flexibility	Improved Production Plan Achievement Reduced Inventory Obsolescence
Responsiveness	Improved Source/Make Cycle Time
Costs	Impacts Purchase Order Costs Reduced Quality Returns
Asset Management	Increase Capacity Utilization Decrease Inventory Obsolescence

Appendix B: Best Practices

Key BEST PRACTICE Success Factors/Implementation Issues:

KSF	Comments
Technology	Accessibility, accuracy, timeliness and visibility of enterprise-wide procurement information. Commercial software (of varying degrees of sophistication) is available to support the procurement and planning processes.
Training/Education	Commodity / Procurement Lead Local Procurement Representative
Sponsors	Supply Chain Managers, Quality, Accounts Payable, Engineering, Sales and Marketing functions
Shared Vision	Develop relationships that are highly customizable based upon the type of product or service being purchased (strategic, off-the-shelf, engineer to order products, systems, etc.)
Measures/Milestones/Feedback	Key measures include: Supplier Delivery Performance (Supply Chain Response Time) Supplier Quality Performance Continuous Improvement Costs Total Product Costs (product, delivery, quality, handling, etc.)
Communications/Best Practice Exchange	Due diligence in contracts and Sarbanes Oxley. Scheduled communication events support formal exchanges of information (i.e. enterprise vision, mission and strategic goals, and organizational changes).

Appendix B: Best Practices

Best Practice: Cross-Docking

SCOR Process Number: D1.8 / D1.11 / D1.12 / ER.6
SCOR Process Name: Receive Product from Source or Make /
Load Product & Generate Shipping Docs / Ship Product / Manage Return Transportation

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Unique Best Practice Title: Cross-Docking

BEST PRACTICE Need Indicators:

- Need to consolidate and reduce safety stock and inventory cost, while meeting the economics of large shipment sizes
- Constrained distribution center capacity
- Perishability of products
- Excessive inventory and cost
- Need for improved inventory velocity
- Need to bundle pallets and shipments
- Need to improve carrier utilization
- Transportation costs
- Operating costs

BEST PRACTICE Definition/Description:
Cross-docking is a practice used in many distribution centers (DC) as a strategy to reduce inventory levels by increasing inventory velocity while maintaining shipping efficiency. In a traditional DC, the receiving process is disjointed from the shipping process; storage acts as an intermediary between the two processes. Cross-docking actively links the receiving and shipping processes. Cross-docking is also an intermediate step between the storage and shipping processes to improve load efficiency. In a DC, both cross-docking (no storage) and traditional (with storage) operations might take place. Both can be considered best practices.

Many types of cross-docking exist, most based on the time it takes to move the inventory through the facility. However, all intend to either minimize or totally eliminate the need to put incoming inventory into storage. Also, all intend to minimize the number of "touches" for each order. The key to accomplish this is to link the receiving activity with open order status. Cross-docking is a planned activity where an inbound shipment has a planned outbound already scheduled. When an item is received and electronically scanned, the system will look to the open order file to find its outgoing order. The item is then moved from receiving directly to the order staging area, order pick area, or into an outbound vehicle. In some cases, shippers will send an Advance Ship Notice (ASN) via EDI to alert the receiving facility that the material is coming. This will allow the receiving facility to more productively schedule order picking and outbound deliveries.

Three of the more common types of cross-docking are:
Transshipment – the order received at the DC is already packaged for delivery to the customer;
Flow-through – some sortation or break bulk is needed when the order is received;
Merge-in-transit – current inventory in storage at the DC is added to the incoming order; many times some type of value-adding activities are performed on the order; this will be discussed under a separate Best Practice.

Cross-docking has some potential benefits for the DC. First, it helps reduce average inventory levels allowing the DC to better utilize its capacity. Second, it can speed delivery of orders to the customers. Third, it can speed cash flow since most billings are done on ship date. Fourth, it can help save transportation costs and improve efficiency of transportation assets. Fifth, it can reduce the total working capital invested in inventory.

Suppliers usually need to make some type of investment to participate in cross-docking with their customers. Customized bar codes, special overpacks, or unique pallet patterns might be required at the suppliers facility to speed the movement of their products through their customer's DC's. However, suppliers that comply with these requirements many times are rewarded with more volume from their customers.

Appendix B: Best Practices

Affected Supply Chain Performance Attributes/Metrics:

Attribute	Experienced Impact
Reliability	Delivery performance (cycle time) can be reduced for most customers. Might improve based on the ability to avoid some stockouts. Will improve with better on-time delivery
Flexibility	Can improve delivery times. DC flexibility; gives the DC more options for order picking.
Responsiveness	Should go down but also should become more consistent.
Costs	DC inventories will be reduced; labor will become more productive; suppliers might incur an initial investment. Storage costs will be reduced, while handling costs might increase. This increase will be partly offset by a reduction in transportation costs. Will be reduced because of the reduced inventory levels in the DC. DC labor becomes more productive at receiving, put-away, and picking.
Asset Management	Will improve with increased velocity through the DC. Will decrease. Will increase for inventories and possibly for transportation vehicles.

Comments:
These are customer measures.
Cross-docking might also be able to reduce DC storage space requirements.

Appendix B: Best Practices

Key BEST PRACTICE Success Factors/Implementation Issues:

KSF	Comments
Technology	This application requires the use of some type of Warehouse Management System (WMS) in use at the DC. Preferably, bar codes and RF scanners will allow the receiving function at the DC to become more productive. The WMS needs to interface with the order management system in the DC. Suppliers will be more valuable if they have EDI capabilities as well as bar code generation capabilities. The WMS also needs the ability to pass all final destination information to the cross-docking operation in order to create accurate, multi-stage movements that would route the order from the point of receipt to the customer. The use of ASN's is highly beneficial. An ASN is an electronic (EDI) message called an Advance Ship Notice. The shipper sends it to the receiver as a notice that a shipment has been sent.
Policies/Procedures	A strong relationship with the supplier is necessary. Agreements between the supplier and DC would be necessary on the following: • which products • documentation/labeling (e.g., bar code structure) • packaging • pallet patterns
Training/Education	Training at both the supplier and DC locations will be necessary. For the supplier, training on the specific requirements (as noted in policies/procedures) of a customer must be developed. For the DC, training on how to handle cross-dock product versus standard receipt-to-storage product will be necessary.
Sponsors	Upper management at both the supplier and DC locations is a requirement since some investment on the part of both parties might be necessary. Plus, the supplier might see an initial increase in operating costs.
Shared Vision	Since this is a collaborative agreement between a supplier and its customers, a shared vision of the following is required: • goals • types of information sharing • understanding of roles and responsibilities • risk-reward results • review periods
Measures/Milestones/ Feedback	An analysis needs to be undertaken to understand the impacts of cross-docking at the DC for: inventory levels, speed through facility, put-away productivity, and pick productivity before and after implementation. The supplier needs to monitor implementation and operating costs. Usually, the DC will also generate supplier compliance reports on a quarterly basis.
Rewards/Recognition	Continued compliance by the supplier should result in preferred supplier status from the customer. DC productivity improvements are major KPIs in most organizations.
Guidance Structure and Process	A detailed plan for implementation should be developed. Many retail organizations have Centers of Excellence for best practices that help implement new processes at DC's.
Quick Wins/Local Innovations	Most implementations begin with one or a few selected suppliers across a limited number of products. This works best with high, stable volume products.

Appendix B: Best Practices

Comments:

Possible implementation difficulties are outlined below:
Hurdles surrounding the packaging of products in quantities/ sizes required for cross-docking: Usually there is not much of a value proposition (that a company planning to cross-dock) that can be offered to the suppliers. It puts the onus of extra handling of products on the supplier, for the benefit that the cross docking company can reap.

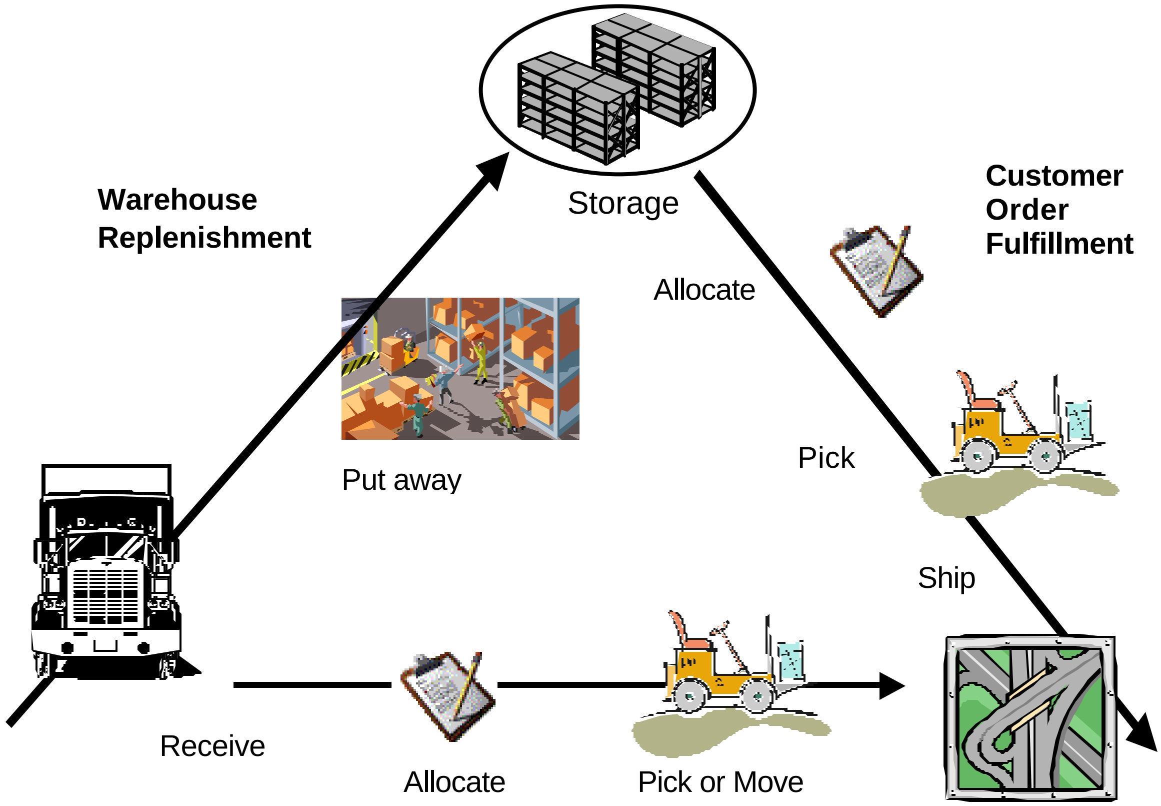
Efficient management of dock doors: Generally dock door availability (and staging space around the doors) is the bottleneck in many warehouses. Cross-docking calls for very efficient management of these resources. This again could mean limited and predefined time windows for vehicles to be at the dock.

Cross-docking requires sound transportation planning. Inbound loads must have a corresponding outbound door. In order to meet operational efficiency targets, the outbound loads have to have significant mass (preferably heavy LTL or Truckload). Finally, goods must transition of the outbound dock as quickly as possible without disrupting operations or requiring storage.

In a situation where rainbow (mixed product) pallets are received into a DC for cross-docking, inbound transportation costs per pound would be higher than for the movement of straight (single product) pallets. This occurs because rainbow pallets cannot be stacked on top of one another in a transportation vehicle. However, rainbow pallets highly maximize DC efficiency because there is no need to break down the pallet. Outbound transportation costs will not be affected.

Discussion of Relative Costs of Implementation:
Both the supplier and customer will require investment in technology, if it does not already exist. This would include, but not be limited to: WMS systems, bar code capabilities, RF scanners. Increased labor costs at the supplier locations might occur. Training costs and lost productivity during initial phases of the implementation are likely to occur.

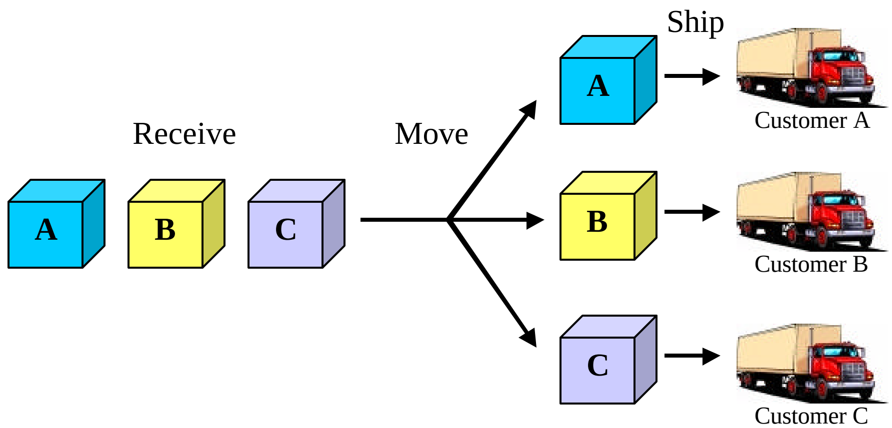
Profile of Company where this BEST PRACTICE is most applicable:
Mostly seen in environments where demand is high and fairly stable for items in a DC. This also works well for seasonal or highly perishable items. Most orders received by the DC are multiple line. This is a very scaleable process across many industries. This practice would probably not be applicable to the distribution of chemicals in bulk. Also works well when minimum pick quantities in the DC are at the case level and where some types of conveyor systems are in place. Frequently seen in the retail sector. Can increase the benefits to transportation consolidation efforts of less-than-truckload into truckload shipments.



Cross Docking

Courtesy: Robert Novack, Penn State University, University Park

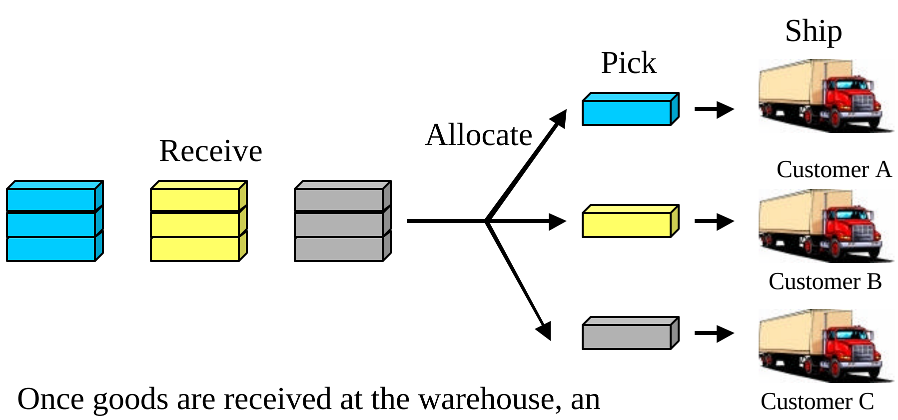
Transshipment



Inbound loads are packaged and designated for a specific customer before they arrive in the warehouse

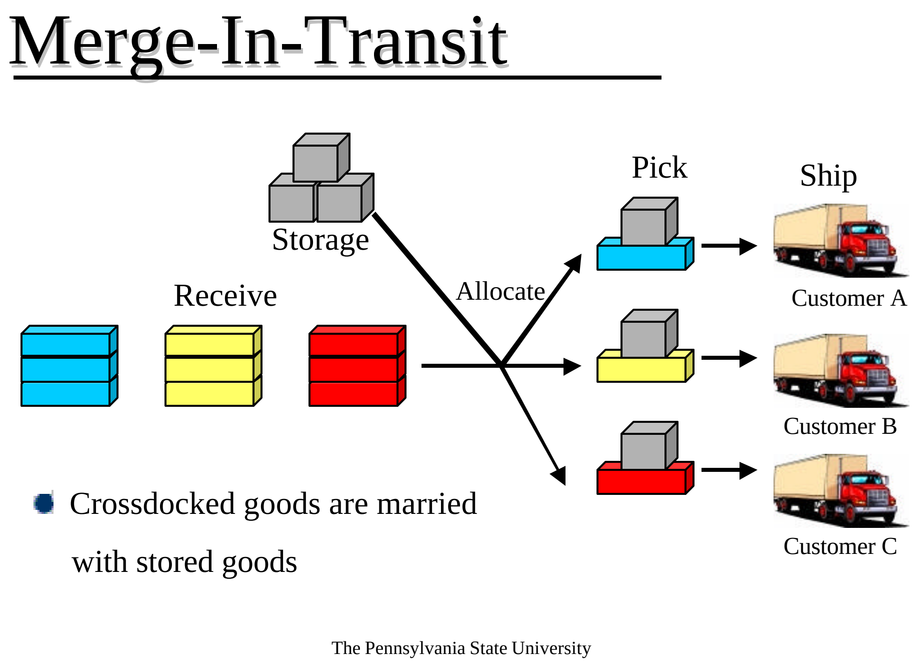
The Pennsylvania State University

Flow Thru



Once goods are received at the warehouse, an allocation process determines where *components* of the load are destined

The Pennsylvania State University


Merge-In-Transit
Storage
Receive
Allocate
Pick
Ship
Customer A
Customer B
Customer C
Crossdocked goods are married with stored goods
The Pennsylvania State University

Appendix B: Best Practices

Best Practice: Drum-Buffer-Rope Scheduling Technique

SCOR Process Number: M1.1, M2.1, M3.2
SCOR Process Name: Schedule Production Activities

<u>Unique Best Practice Title:</u> Drum-Buffer-Rope Scheduling Technique

BEST PRACTICE Need Indicators:

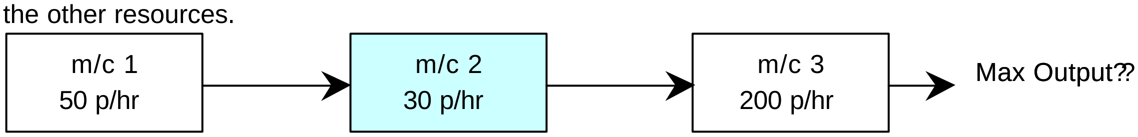
- High WIP with deteriorating throughput
- Confusion on the shop floor
- Unpredictable manufacturing lead times
- Lack of proper manufacturing prioritization

<u>BEST PRACTICE Definition:</u>
The APICS Dictionary (9^{th} Edition) defines DBR as: "In the Theory of Constraints (TOC), the generalized technique used to manage resources to maximize throughput. The drum is the rate or pace of production set by the system's constraint. The buffers establish the production against uncertainty so that the system can maximize throughput. The rope is a communication process from the constraint to the gating operation that checks or limits material released into the system to support the constraint." (Note that TOC/DBR can be referred to as Synchronous Manufacturing, Constraint Management, etc.) It is also worth mentioning that the TOC with its DBR technique and thinking processes have been applied to other fields such as project management, corporate strategy, marketing, etc.

<u>BEST PRACTICE Description:</u>
In a manufacturing environment DBR is to TOC (Theory of Constraints) what Kanban is to JIT. It helps implement the standard TOC approach of identifying and exploiting a system's constraint. Goldratt summarizes the Throughput World's decision process in the following steps:

- Identify the System's Constraint(s)
- Decide how to exploit the system's constraint(s)
- Subordinate everything else to the system's constraint(s)
- Elevate the system's constraint
- If, in the previous steps, a constraint has been broken, go back to step 1, but do not allow inertia to cause a system's constraint.

The **Drum** is the system's constraint (or bottleneck) that sets the pace for the entire organization. The graph below shows how a bottleneck determines the final output of the system regardless of the excess capacity that might be available on the other resources.



In DBR terminology, the drum is also the schedule of the constraint. The **Drum Buffer** is a time offset that helps achieve the previously stated goal of exploiting the drum by having it running all the time. By placing this time offset in front of the drum we help reduce/absorb the impact of uncertainty along the production chain from the gating operations all the way to the constraint. This uncertainty might materialize in the form of breakdown of machines feeding the drum, scheduled maintenance, labor absenteeism, etc. The drum buffer can be seen as a powerful tool in helping us prevent the drum from starving. In more practical terms, the drum buffer (or time offset) is propagated backward to the gating operations and will result in raw material being released earlier than expected by the conventional lead time. By releasing earlier we will help maximize the probability that the lot will get to the drum at the required time or a little bit earlier if it encounters (as we would expect!) the laws of statistical fluctuations. The **Shipping Buffer** is also a time offset that helps protect the customer due-date. By including it in our model we will try to get products to the shipping area at or earlier than the expected delivery date/time.

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The **Assembly Buffer** is a time offset placed at the levels of the main production converging points and helps synchronize production. In fact, a common problem in assembly is the synchronization between the different production sub-lines feeding the sub-assembly work center. By placing assembly buffers on the lines that have been usually struggling to get to the sub-assembly w/c at the same time with the other feeding lines, we will help better synchronize our production system and also reduce unnecessary WIP.
Determining the appropriate buffer sizes is more of an art than a science. The rule of thumb is to start with a large buffer size and keep reducing it until we have a smooth flow. Needless to say that the smaller the buffer sizes, the shorter the lead times and hence the faster the production flow.

The **Rope** is the material release schedule tied to the drum. In other words, we are trying to make sure that no material is released to the shop floor without the "prior approval" of the drum. The shop floor has a virtual rope tying the drum to the gating operations, each time the drum finishes a lot it will pull this rope to ask for more material to be released.

This is an extremely powerful concept that has an immediate impact on both lead time and WIP. Release only what is needed when it is needed! This further enhances the idea of a global management vs. a localized approach where material is released whenever there is available capacity on the "next" work center. Besides, one of the foundations of TOC/DBR is to have a rigorous First-In-First-Out shop floor policy used at all work centers. This has a immediate impact on WIP and lead time control and reduction in addition to its obvious impact on proper prioritization.

DBR Best Practice in Effectiveness Measurement – Overall Equipment Effectiveness (OEE)

Definition: OEE is a measure (metric) of the effectiveness of a manufacturing process during scheduled run time. OEE is the result of multiplying ***Availability*** (up-time) X ***Quality Rate*** (yield) X ***Performance Efficiency***. Any resulting number of less than 1.0 represents production lost (waste).

Use: OEE is a metric that complements the implementation of the Theory of Constraints (TOC) in a manufacturing operation. The objective of TOC is to maximize the throughput of constrained resources; OEE applies a metric that measures the success of that objective. It reflects the ***Reliability*** as well as the ***Asset***

Management of a supply chain, and forms the basis for continuous improvement activities in a manufacturing environment.

Description: In the application of TOC ***Drum-Buffer-Rope (DBR)***, the effectiveness of pace setting operation (drum) is the critical link in the chain of events that leads to maximizing the throughput of the operation. OEE is the single metric that reflects that effectiveness and provides the data necessary to improve performance. The three components of OEE are:

- *Availability*. This number is the result of run time divided by scheduled time (also 1 minus downtime) and cannot be greater than 1.0.
- *Quality Rate*. This number is the result of dividing first-pass good units produced by total units produced (sometimes referred to as first pass yield) and cannot be greater than 1.0.

- *Performance Efficiency*. This number is the result of dividing the theoretical cycle time by the actual cycle time. Theoretical cycle time is a most important concept and one that deserves discussion. Most production equipment is justified on the promise of the manufacturer that the equipment is designed to achieve a specified cycle time. In practice, that cycle time is often “downgraded” by industrial engineers who apply factors, such as PF&D (personal, fatigue, and delay), to derive a “standard cycle time” used to cost the product and provide planning an attainable scheduling/capacity quantity. Often this “standard output” per hour, per shift or per day, etc., is also used to monitor the performance of a work center or production line. To properly utilize OEE in support of TOC, the integrity of the theoretical cycle time must be maintained. This cycle time should be based upon machine capability, unadjusted by other factors. For example, a typical production machine (pick &place, plastic molding, etc.) has a “dry cycle” that can be measured without the introduction of materials. Applying the Theory of Constraints, the first question to be addressed is, “What prevents the same cycle time in the production mode with actual production materials?” Whatever constraint is identified (distance, heating, cooling, etc.) should then be addressed and the cost/benefits evaluated to determine whether action should be taken to remove that constraint. Once we are satisfied that the theoretical cycle time is the fastest cycle time that can be designed for a given product, that becomes the cycle time for OEE calculation. In everyday use, the performance efficiency factor can be computed easily by multiplying the units of production output (total good and bad) times the theoretical cycle time per unit and then dividing by run time (up-time), and it cannot be greater than 1.0.

Application: OEE should be utilized in any supply chain situation where the constraint (bottleneck) is identified as production capacity. An OEE of less than 1.0 indicates the percentage of production lost to ineffective operations. Examining the components of OEE will enable root cause analysis, help direct corrective action, and show the real costs of the “hidden factory”. For example, if yield is the main contributor to low OEE, it becomes clear where to focus; if availability is low, perhaps machine or maintenance issues are the main factors. To be recognized as “world class”, an OEE above .85 is standard. OEE has application beyond potential bottlenecks in a supply chain and can complement any operation intent on improving throughput. Its use in supply chain performance (reliability and asset management) helps the “balanced scorecard” by adding a production-focused metric. OEE is an extremely powerful metric on the shop floor as its components are understandable to shop level supervision and personnel; it is not encumbered by “industrial engineering standards” that are often difficult to decompose. One of the greatest uses of OEE is in the corrective action process where investment is needed. Utilizing OEE and its components one can set an improvement target, determine the cost of those improvements, and compute the payback (return on investment).

Appendix B: Best Practices

Key BEST PRACTICE Success Factors/Implementation Issues:

KSF	Comments
Technology	Access to resource loads and production schedules will help in determining the primary constraint(s) (drums). Leveraging proper scheduling algorithms to schedule and fully exploit the identified drum(s) and therefore maximize the throughput of the system. However, DBR can also be implemented manually depending on the complexity of the production planning environment. Generating simple reports to track jobs on the drum(s) while ensuring proper buffer management and release of raw material will drive immediate benefits in terms of WIP and lead time reduction.
Policies/Procedures	A challenge/opportunity of DBR is the need to depart from typical cost accounting concepts such as the overall efficiency of the system is maximized by trying to fully exploit all available work centers. TOC/DBR disputes that claim and recommends exploiting the drum to its fullest extent while using non-constraints only as needed (*the sym of local optima is not necessarily a global optimum)*. Any additional use will result in unnecessary WIP. Using DBR is therefore in conflict with well-established concepts. In addition, respect of the FIFO rule in scheduling jobs is critical to the success of DBR as it will ensure proper prioritization of jobs in production.
Training/Education	Awareness training of what DBR is and how it works is needed People need to be trained on the key concepts of DBR and go through some simulation showcasing the basic principles. Leveraging existing real data in simulating the DBR impact will help secure buy-in.
Sponsors	Materials management, including upper management support, and strong sponsorship from the customer's production department is required. Shifting from "run the machine" all the time to "run it only when needed (if not a constraint" is a significant change and could make some people uneasy about their role/job. Strong executive leadership is needed to make the shift from classic efficiency considerations to TOC/DBR throughput-driven thinking.
Shared Vision	Making a DBR implementation a success is a team effort. Clear focus on exploiting and supporting the drum(s), abiding by the FIFO rule and departing from archaic cost considerations will help increase throughput (that's the real goal/vision of the entire company)
Measures/Milestones/ Feedback	Value can be driven by keeping track of tangible (lead time reduction, WIP reduction, throughput increase, etc.) and intangible (more manageable shop floor, clear priorities, etc.) metrics. Feedback is needed to optimize buffer sizes and determine additional improvement opportunities. (never let inertia become the system's constraint)
Rewards/Recognition	Respecting schedules and embracing new concepts should be rewarded.
Guidance Structure and Process	Using experienced applications providers helps to support implementation of VMI It helps if one on the partners has prior VMI experience.
Quick Wins/Local Innovations	Like many new process implementations, a small, local success helps in institutionalizing and in selling the program. A part of the trial implementation should be a cost analysis. It may be that organizational competencies are so good that VMI will reduce performance. Some companies are investigating reducing VMI for ordering their own parts, due to cost considerations.
Communications/Best Practice Exchange	Success with VMI is directly proportional to the ability of partner organizations to collaborate.

<u>Discussion of Relative Costs of Implementation:</u> Depending on the complexity of the system, DBR can be implemented either manually or with the help of software. Oftentimes DBR costs are only those associated with implementing proper scheduling algorithms. Once the key concepts are embraced and understood (change management is key), DBR can be implemented rather quickly.

Profile of Company where this BEST PRACTICE is most applicable:
This BEST PRACTICE is applicable to virtually any manufacturing environment. Complex manufacturing environments are the ones that could potentially profit the most from this methodology.

Appendix B: Best Practices

Glossary:

Buffer – In the theory of constraints, buffers can be time or material and support throughput and/or due date performance. Buffers can be maintained at the constraint, convergent points (with a constraint part), diverging points and shipping points.

Buffer Management – In the theory of constraints, the process in which all expediting in a shop is driven by what is scheduled to be in the buffers (constraint, shipping and assembly buffers). By expediting this material into the buffers, the system helps avoid idleness at the constraint ad missed customer due dates. In addition, the causes of items missing from the buffers are identified and the frequency of occurrences is used to prioritize improvement activities.

Drum – In the theory of constraints, the constraint is viewed as a drum and nonconstraints are like soldiers in an army who march in unison to the drumbeat; the resources in a plant should perform in unison with the drumbeat set by the constraint.

Rope – In the theory of constraints' drum-buffer-rope system, the rope consists of the minimum set of instructions to ensure that (1) nonconstraint resources are used (and not over activated or misallocated); and (2) material is released into the system and flows to the buffers in a way that supports the planned overall system throughput.

Protective Capacity – A given amount of extra capacity at nonconstraints above the system constraint's capacity, used to protect against statistical fluctuation (breakdowns, late receipts of materials, quality problems, etc.) Protective capacity provides nonconstraints with the ability to catch up to "protect" throughput and due-date performance.

VAT Analysis – In the theory of constraints, a procedure for determining the general flow of parts and products from raw materials to finished products (logical product structure). A V logical structure starts with one or few raw materials and the product expands into a number of different products as it flows through divergent points in its routings. The shape of an A logical structure is dominated by converging points. Many raw materials are fabricated and assembled into a few finished products. A T logical structure consists of numerous similar finished products assembled from common assemblies, sub-assemblies and parts. Once the general parts flow is determined, the system control points (gating operations, convergent points, divergent points, constraints and shipping points) can be identified and managed.

Additional Readings:

- *Synchronous Manufacturing – Principles for World Class Excellence* by Michael Umble and Mokshagundam L. Srikanth, Spectrum Publishing Company – 1995
- *The Constraints Management Handbook* by Michael S. Spencer and James F. Cox - The St. Lucie Press/Apics Series on Constraints Management – 1997
- *Overall Equipment Effectiveness* by Robert C. Hansen, New York, N.Y., Industrial Press, Inc. – 2002
- Synchronous Manufacturing Quick Reference Guide, by Mondher Ben-Hamida, Supply Chain Strategy and Solutions, BearingPoint, Inc.

Appendix B: Best Practices

Best Practice: **ERP-based Environmental Performance Indicator module**
SCOR Process Numbers: P3.3 / EM.3 / EM.5 / EM.8
SCOR Process Names: Balance Production Resources with Product Creation Requirements / Manage MAKE Information / Manage Equipment and Facilities / Manage MAKE Regulatory Compliance

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Unique Best Practice Title: ERP-based Environmental Performance Indicator module (EPI module)

BEST PRACTICE Need Indicators:
High administrative costs to fulfill reporting requirements by environmental agencies

BEST PRACTICE Triggers:
High administrative costs to fulfill reporting requirements by environmental agencies
Low transparency concerning environmental issues and thus low flexibility to react to upcoming regulations such as emissions trading, European chemicals directive (REACH), etc.

BEST PRACTICE Definition/Description:
Use of the company's ERP System to collect and evaluate environmental information in an ERP based Environmental Performance Indicator module. Environmental information in this context focuses on the use and disposal of materials and substances.

This process was developed through a research project supported by the German Federal Government, involving the Fraunhofer Institute for Industrial Engineering (IAO) and German glass manufacturer Schott Glas.

The vision of such a project in general is to be able to control and manage the environmental performance of a company resulting in a more efficient use of materials and less emissions and thus lead to a higher material efficiency and thus create a lower impact on the environment. This can also lead to a higher motivation for employees and a better standing of company in society by showing a higher Corporate Social Responsibility.

Environmental information in companies is usually spread over different information systems. It also often represents specialized knowledge that cannot be traced to particular sources. This hinders the ability of environmental management systems to meet requirements of ISO 14000 or the EU Eco-Management and Audit Scheme (EMAS). The Schott project shows how that problem can be solved.

When the project started, the representative company had a multitude of environmental information clusters – on water and energy consumption, waste volumes, recycling, emissions, occupational safety – along with their associated costs. This data was recorded and maintained in different parts of the company in autonomous spreadsheet databases, as well as in the company's ERP System. It took considerable time to collect and process the information from heterogeneous data to produce internal reports. Schott decided, therefore, to locate this data centrally in its ERP System so that reports could be created directly in the system.
The following topics were particularly required for reports:

- waste balances
- industrial hygiene and safety reports
- environmental protection costs, as legally required for the Federal Statistical Office in Germany
- cost-center-based environmental information for individual company areas
- emissions as a basis for the planned EU emissions trading system

Existing environmental information was first restructured and hierarchically organized by topic before being organized into an Environmental Performance Indicator system. Environmental Performance Indicators (EPI) refer to absolute quantities and costs of materials, substances, and energies – for example, the amount of a particular production waste in kilograms. At the same time, relative performance indicators set individual consumption values in relation to output quantity. The performance indicator detail ranges from business year to monthly consumption. EPI could then be assigned to the cost centers responsible for waste generation. That meant that the existing cost center key could be used, with minimal adjustment.

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It was implemented in the Management Information System (MIS) of the company's ERP System, where the appropriate data structures for Key Performance Indicators can be defined and special report options used. On-going research from Fraunhofer IAO shows that many ERP Systems available on the market have the flexibility to define Environmental Performance Indicators as Key Performance Indicators.

Data entry takes place monthly at Schott: ERP internal data is imported into the MIS and specialist information is uploaded from external data sources. Data can also be entered manually, if required. From this data, the environmental performance indicators are calculated in MIS, and the details for each cost center displayed, as well as totals for different organization levels. Breakdowns are provided by cost centers or by month and business year.

The reports can be used by company managers, area managers, and employees responsible for site controlling or environmental protection and industrial hygiene and safety. A role concept enables the information to be displayed according to the needs of the user. At the beginning of each month, the performance indicators for environmental protection and industrial hygiene and safety from the previous month are available in the EPI module. Users can view the indicators at their work place in the ERP System, and generate reports to carry out more detailed evaluations. For individual cost centers, the performance indicators can be used as control quantities in decision processes.

ERP Systems can, with some customizing, support planning and decision processes in the areas of operational environmental protection and industrial hygiene and safety. The programming required for the EPI module was little, since existing functionalities for data input, calculation, and display of the environmental key figures could be used. However, the structuring of the imported data and associated discussions with staff in different areas involved significant effort.

The concept developed at the representative company is flexible, adaptable, and transferable to other companies. In principle, an EPI module can be implemented using an existing ERP System or Data Warehouse software.

Affected Supply Chain Performance Attributes/Metrics:

Attribute	Experienced Impact
Flexibility	Offers opportunities for company to react to future regulations
Costs	Decreased bureaucracy costs to comply with environmental regulations COGS is affected

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Key BEST PRACTICE Success Factors/Implementation Issues:

KSF	Comments
Technology	This practice requires the use of a flexible ERP System that has the ability to administer Key Performance Indicators (KPI), which can be used for Environmental Performance Indicators (EPI). EPIs are displayed in units such as kilogramme, kiloJoule, tons, Euros/dollars, …(absolute numbers), ratios, or relative indicators (i.e. kg of mass input per production cost). The ERP System must be capable to handle such metrics.
Policies/Procedures	Potential users should be involved early in the process to achieve high acceptance of future software module. Interdisciplinary teams should be built (from accounting, software dep., environmental dep.,) and sufficient resources should be planned to structure environmental information, which can be a very a time-consuming tasks.
Training/Education	Training should be provided for the EPI module in the ERP System.
Sponsors	Strong continuous top management support is necessary to successfully complete project. Mapping EPIs leads to a higher transparency in the enterprise, which might be resisted by some managers.
Shared Vision	Vision of such a project is to be able to control and manage the environmental performance of a company resulting in a more efficient use of materials and less emissions.
Measures/Milestones/ Feedback	Completion of the structuring of environmental information can be the milestone before software implementation starts, software implementation should be started with a prototype, user feedback should be requested continuously and be included into on-going work.
Rewards/Recognition	Higher motivation for employees, better standing of company in society by showing a higher Corporate Social Responsibility.
Guidance Structure and Process	A detailed plan for implementation should be developed. Fraunhofer IAO can provide a generalized implementation plan that was developed in the research project (only available in German).
Quick Wins/Local Innovations	Implementation prototype should be discussed in the project group to show feasibility and demonstrate usefulness of approach.
Communications/Best Practice Exchange	Other projects concerning Sustainability Performance Indicators (SPI) deal with similar issues.

<u>Discussion of Relative Costs of Implementation:</u> Usually requires some personnel resources for adapting ERP System and personnel resources to structure environmental information and define interfaces. Investment in hardware or software should be very small, if existing ERP System can be used. Measurement equipment might be required or programming of interfaces.

Profile of Company where this BEST PRACTICE is most applicable:
Most applicable with medium or large companies from process industry.

(i) Companies that are required to file “Environmental” reports, and
(ii) Companies that position themselves as “Green” companies.

Best Practice: Inventory Cycle Counting

SCOR Process Numbers: ES.4 / ED.4 / ED.5 / ES.5
SCOR Process Names: Manage Product Inventory / Manage Finished Goods Inventory / Manage Deliver Capital Assets / Manage Capital Assets

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Unique Best Practice Title: Inventory Cycle Counting

BEST PRACTICE Need Indicators:
There is an accuracy requirement in every company that stocks materials and uses a perpetual inventory record to plan that material. In order to plan, promise, allocate and control purchased, manufactured, and finished goods the inventory accuracy for each line item must be as close to 100% as possible. The proven method for doing this is called cycle counting

BEST PRACTICE Triggers:
Unplanned shortages
Poor customer service
Excess inventory
Expediting
Unplanned obsolescence

BEST PRACTICE Definition/Description:
The primary purpose of cycle counting is error detection, root cause analysis, and the elimination of problems that contribute to inaccuracy. The method used is to count on a regular basis (e.g. daily) a representative random sample of active stock keeping units.

The ABC approach is most commonly used (see best practice ABC inventory control). That is; throughout the year A items are counted more frequently, B items less, and C items counted at least once per year. For example a count frequency could be, A items, 4 to 6 times per year, B items, 2 to 4 times per year, and C items 1 to 2 times per year. Influencing the decision would be the part number population, and number of locations as well. Also, the size and number of the storage areas, security, written policies and procedures as well as education and training must be considered.

Affected Supply Chain Performance Attributes/Metrics:
The minimum standard for acceptable inventory accuracy is 95% plus as measured by each stock keeping location. A weekly run chart should be posted in a highly visible are to monitor progress.

Attribute	Experienced Impact
Reliability	Improved order fulfillment due to inventory record accuracy. Inventory is where it says it is. Fewer material shortages.
Flexibility	Accuracy of inventory information insures that production schedules can be modified as needed. Fewer work stoppages due to lack of material.
Responsiveness	Accuracy of inventory information insures performance to schedule in production, and recognition of finished goods availability for customer orders. Reduced supplier expediting
Costs	Inventory accuracy and associated record keeping enables recognition of inventory issues that impact costs.
Asset Management	Inventory accuracy is necessary for calculation of metrics such as inventory turns. Impacts include: Reduced inventory investment

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Key BEST PRACTICE Success Factors/Implementation Issues:

KSF	Comments
Technology	Current software packages have cycle counting functionality
Policies/Procedures	Written policies and procedures signed off by the management team are paramount to the success of the program
Training/Education	Employees involved in cycle counting must be trained in the methodology, including any data entry requirements.
Sponsors	Materials Management
Measures/Milestones /Feedback	For most items the goal is 95%+ inventory accuracy.
Rewards/Recognition	Recognition of materials personnel when inventory accuracy reaches desired levels (e.g. 95%+).
Guidance Structure and Process	Policies and standard operating procedures.

Discussion of Relative Costs of Implementation:
Implementation costs are more than offset by the benefits
However, a cost/benefit analysis should be made prior to going forward with the cycle counting program.

Profile of Company where this BEST PRACTICE is most applicable:
Any company where physical inventory is held, particularly manufacturers who stock raw materials, spare parts, and finished goods.

For Further Reading:
Ref.
1. “Back to Basics, your guide to manufacturing excellence”,
Melnyk & Christensen, St. Lucie Press/APICS Series on Resource Management

2. SAP software documentation.

Best Practice: Merge-In-Transit

SCOR Process Number: D1.8 / D1.9
SCOR Process Name: Receive Product from Source or Make / Pick Product

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Unique Best Practice Title: Merge-in-Transit

BEST PRACTICE Need Indicators:
- Customer orders require commingling of products from different sources into a single shipment
- Reliable order delivery to customer essential
- Customer orders include make to order items as well as make to stock items

BEST PRACTICE Definition/Description:
Merge-in-transit is a practice used in some supply chains where customer orders require: 1) combining items from multiple sources into a single customer shipment; and/or 2) combining make to order items with make to stock items into a single shipment. This practice is usually performed in a shipper's distribution center (DC) or in a carrier's terminal. In either case, the items to be merged are essentially cross-docked from inbound receipt to outbound shipping (see Best Practice on Cross-Docking for a further discussion). Merge-in-transit might or might not require inventory to be held at the merge facility. In either case, it is imperative that suppliers have accurate forecasts of product demand from their customers.

Three examples of this practice will show the benefits of merge-in-transit as follows: a DC where the multiple line orders might not be shipped pending receipt of all items; the adding of orders to a load already in route (e.g., a milk run via motor carrier); or, ensuring that all items are on-hand before shipment from a manufacturing site.

1. A catalogue retailer picks, packs, and ships single item and multiple item orders to customers in single shipments. To support this, the retailer maintains stocked inventory of selected items in its DC's. Some multiple item orders might contain items not currently stocked in these DC's, requiring the retailer to order those items from the supplier or transferring them from another DC. Some retailers give the option to their customers of receiving a single shipment or multiple shipments. If the customer is willing to received more than one shipment, the on-hand inventory is shipped and when the non-stocked inventory becomes available, it is shipped separately. This could increase both inbound (to DC) and outbound (from DC) transportation costs. When a single shipment is desired by the customer with a guaranteed delivery date, the inbound items are merged with the items in stock to complete the order at the original DC. When the items are received and scanned at the DC, the open order file is accessed to determine if these items are already designated for an order. If so, they are cross-docked and combined with the stocked inventory items for shipment. This practice is transparent to the customer. This also will require the retailer having upstream inventory visibility at its suppliers or other DC's.
2. A motor carrier (can be small package, LTL or heavy LTL) is under contract to provide merge activities at its terminals for a client. This client's customers normally place multiple item orders. The carrier will provide pick-up of items at multiple supplier locations (could be single item pallets, rainbow pallets, or individual items) and return them to its merge facility. This type of operation would not require any type of long-term storage of stocked inventory at the carrier's facility. In effect, all of these items are cross-docked. The carrier's personnel would then sort and combine items into single customer shipments that would be delivered by the carrier's vehicles. This type of operation would require real-time inventory/order/shipment schedule information exchange among the suppliers, the client, and the carrier since no inventory is stocked at the carrier's facility to offset stockouts or other exceptions.

3. A manufacturer provides a bundled product line for its customers (e.g., a manufacturer of desktops for the business or consumer markets would manufacture the main processing component and would source the acquisition of monitors, keyboards, printers, etc., from other suppliers). Critical in this example is the fact that the customer needs to receive all items at the same time in the same shipment for the product to be effective. In many cases, the manufacturer is making the main units to order while the accessory items (monitors, etc.) are kept in inventory in a DC and are made to stock by the supplier. When the DC receives the main units and they are scanned, the open order file is accessed to verify an order match with the appropriate units from the stocked inventory. The main unit does not enter into storage and is cross-docked to a merge area in the DC. The stocked items are picked and merged with the main unit so a single shipment can be made to the customer. In some cases, the main unit and accessories are consolidated to the order's specifications at a Final Integration Center (FIC) before shipping to the customer. These would require integration between the manufacturing schedule for the main units and the inventory levels of the stocked items.

Merge-in-transit has several benefits. First, it allows the shipper to reduce its inventory levels on selected items in its DC's and still maintain reliable delivery and complete order integrity. Second, it allows the customer to receive all of the items in a single shipment to make the order complete. Third, even though it might increase overall delivery times, it should improve delivery time reliability to customers if the supply chain information systems are integrated among the shipper, its suppliers, and its carriers.

Normally, there will be a need for investments in technology, if none or little are present for all members of the supply chain except the customer. Merge-in-transit practices are usually invisible to the customer. This technology would include at a minimum: bar codes, EDI, and RFID capability.

For make-to-order (MTO) products, the order lead time should be greater than the manufacturing lead time. Otherwise, the products should be manufactured and stocked prior to the shipment. The point is emphasized here to ensure that the proper business policy is adopted around defining MTO versus MTS (make-to-stock) products.

A more explanatory description with diagrams is included at the end of this section.

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Affected Supply Chain Performance Attributes/Metrics:

Attribute	Experienced Impact
Reliability	Delivery time will be influenced by customer desires for a partial or complete shipment; if the latter, total delivery time will increase but reliability and customer satisfaction should improve. Fill rate will improve if customer selects complete order in a single shipment. POF will improve if customer selects complete order in a single shipment.
Flexibility	Response time might increase for both partial and complete shipments. Allows great flexibility in a make to order manufacturing environment if manufacturing lead time is shorter than order lead time; DC flexibility improves because of ability to cross-dock selected inbound items.
Responsiveness	Might increase but reliability will improve
Costs	Distribution Center: For the DC they should decrease. Lower inventory levels in the supply chain will reduce inventory costs; Transportation - inbound (to DC) transportation costs might go up; outbound (from DC) transportation costs should go down if customers select single shipments Total System Perspective: DC productivity will improve; net result should be lower SCM cost unless the risk of a stock-out results in lost sales. Should go down for the shipper because of lower inventories. DC labor is more productive at receiving, picking, and shipping orders. Transportation vehicle capacity utilization should be improved. If a critical mass of customers selects single shipments, more opportunities exist for the DC to consolidate shipments and utilize a higher percentage of the vehicle’s space. Warranty Cost or Returns Processing Cost should go down as mis-picks at the DC should go down.
Asset Management	Cash to cash cycle time might increase but would become more reliable. Inventory Days of Supply should decrease. Asset turns should increase for both inventories and transportation vehicles.

Comments:

- Storage space requirements at the DC’s could be reduced. If this practice is combined with batch picking, DC labor productivity should further improve. (Note: batch picking is a practice where a DC worker picks multiple units of a single SKU from a storage location at the same time. These multiple items will then be used to fill various orders picks.
- The partial or complete shipment option assumes a provider/customer communication link exists to coordinate customer desires.
- Batch picking is a process where a DC worker picks multiple units of a single SKU from a single storage location during one pick activity, these multiple units will then be sorted and merged later in the DC process to fill multiple customer orders.

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Key BEST PRACTICE Success Factors/Implementation Issues:

KSF	Comments
Technology	This practice will require the use of some type of warehouse management system (WMS), bar code and RFID scanner technology, and EDI (or some other technology that would allow the transmission of data between supply chain partners). It might also require the integration of MRP or other scheduling technology with the WMS. All will need to interface with the order management system. Many times suppliers will implement Vendor Managed Inventory (VMI) systems for certain items in the manufacturer customers' DC's.
Policies/Procedures	A strong relationship with suppliers and carriers is necessary. Agreements would need to be made on: * delivery time requirements * inventory policies at the supplier locations * how the merged items will be packaged/combined to produce a single shipment * generation of packing slips and other documentation for the combined shipment
Training/Education	Training/education will be necessary for the personnel in the merge facility since all merge activities require some form of cross-docking. Differences on how to handle cross-dock items versus stock items will be necessary. This is especially true for carriers that have cross-docking experience but little or no order picking experience.
Sponsors	Upper management at the supplier, carrier (where appropriate), and DC locations is required since all supply chain partners must be synchronized to make the merge activities invisible to the customer. Merge-in-transit also requires significant information sharing among supply chain partners.
Shared Vision	Since this is a collaborative agreement among suppliers, carriers, and DC's, a shared vision for the following is required: • goals • types/timing of information sharing • understanding of roles and responsibilities • risks/rewards • review periods
Measures/Milestones/ Feedback	An analysis needs to be undertaken to understand the impacts of merge-in-transit at the supplier locations, manufacturer locations (including DC's), and carrier facilities (where appropriate) for the following: impacts on inventory levels; impacts on transportation costs; impacts on manufacturing schedules; impacts on order fill rates; impacts on delivery times. This analysis should be a prerequisite for the implementation of merge-in-transit.
Rewards/Recognition	If all supply chain partners cooperate effectively in this practice, supply chain inventories should decrease and customer retention rates should increase, allowing for both cost reductions and revenue enhancements to be shared by all partners
Guidance Structure and Process	A detailed plan for execution must be developed since multiple supply chain partners are involved. Many times cross industry benchmarking is effective here as well as using the knowledge base of third party logistics providers who are already engaged in this practice. This detailed plan should be a pre-requisite for the implementation of merge-in-transit.

Appendix B: Best Practices

Comments:
Possible implementation challenges are discussed below.

1. Since effective information exchange is critical for merge-in-transit to work, all involved parties must agree on the types and timing of information exchange. Since DC's will have lower inventory levels as a result of using this practice, extended stock-outs at suppliers or unreliable delivery times by carriers will negatively impact the customer delivery experience.
2. Because merge-in-transit will always require some sort of cross-docking, effective integration of WMS, TMS, and order management systems at the DC's is critical. Otherwise, cross-docked goods will end up in storage, staging areas at the DC will become congested, and outbound transportation will be sub-optimized.

Discussion of Relative Costs of Implementation:
Suppliers, manufacturers (and their DC's), and carriers (where appropriate) will require the use of, at a minimum: bar code and RFID scanning capabilities; WMS and TMS systems; EDI. Increased costs for all partners might occur in the short run as extra inventories and other initiatives might be employed to avoid stockouts and/or delayed deliveries to customers.

Profile of Company where this BEST PRACTICE is most applicable:
Mostly seen in environments where orders contain more than one item. Also seen where orders combine both make to order and make to stock items. Can be seen in industries where the items are seasonal or perishable. Can be used for items at the single unit pick level, case pick level, or bulk pick level. Currently used in the high tech sector and well as in construction materials (e.g., drywall).

Additional Description and Examples

Merge-in-transit is an execution strategy used by firms in markets where customers require multiple line orders delivered complete in a single shipment. For example, in the personal computer market, the customer would need the main processing unit, monitor, keyboard, cables, software, and printer all delivered at the same time to make the personal computer operational. To achieve the goal of a single shipment, merge-in-transit takes advantage of make-to-order (MTO) inventories, make-to-stock (MTS) inventories, and cross docking to combine multiple items from multiple sources into a single shipment to a customer.

Because merge-in-transit is a supply chain execution process, information and operational integration among suppliers, carriers, shippers, and customers are essential. Most times, merge-in-transit will require significant investments in technology and planning at multiple locations within the supply chain to make it effective. Merge-in-transit can take place in manufacturing plants, distribution centers, 3rd party logistics provider facilities (terminals or DC's), or in a Final Integration Center (FIC). To further explain the merge-in-transit concept, four examples will be discussed.

1. Retail Distribution Center

   Most retail DC's will hold inventory in stock to fill store or consumer orders. Sometimes, a multiple line order will require an item not currently in stock at the DC. This could be planned or it cold be a stockout, i.e., storing that item at another source was a management decision or demand exceeded supply. Figure 1 presents an example of how this order will be filled. Assume that an order required Items A, B, C, and D. The retail DC currently only has Item D in stock. The customer needs all 4 items delivered in one shipment. Supplier A is a DC also owned and operated by the retailer. It handles imported goods. It makes regular deliveries of product to the main retail DC. Product is already packaged and labeled for quick DC receipt. Supplier B is a manufacturer that partners with the retailer to allow Item B to be cross-docked at the retailer's DC. Item C was stocked-out so an order was placed with Supplier C for an emergency shipment. In almost all cases, inventories in this scenario are make-to-stock.
   As Items A, B, and C are received at the retail DC, they are cross-docked and merged with the in-stock Item D to complete the order. A single shipment of all 4 items can then be made to the customer. This scenario requires extensive information exchange and inventory visibility within the retail DC and between the retail DC and its suppliers. This is necessary because a delivery date (ATP, or available to promise) must be assigned to the order even though the inventory is not yet physically in the retail DC. Note: cross-docking and ATP are best practices currently described in the SCOR models.

In some Internet distribution operations, customers might not be sensitive to the need to have all items of a multiple line order be delivered in one shipment. In this case, merge-in-transit would not be necessary. The in-stock items would be shipped immediately and the out-of-stock items would be shipped as they became available, either from the retailer's DC or from the supplier. A disadvantage here is that total transportation costs for the items to the customer will increase because multiple, small shipments will be made rather than one larger shipment.

2. Manufacturing Facility

   In some industries, customer orders might require the combination of both MTO and MTS items. This is quite common in the personal computer industry. Figure 2 is an example of merge-in-transit in this type of environment. In this example, a manufacturer is producing main processing units to customer orders. A unit is not assembled unless an order has been placed for it. A 3rd party logistics provider operates a DC that holds MTS inventories of items such as monitors, keyboards, cables, printers, and software. When a processing unit is received at the DC, it is scanned to determine the peripherals required to accompany this unit. The unit is cross-docked to a merge and sort area where it is combined with the in-stock items to be shipped to the customer. This merge-in-transit activity requires significant information sharing among the manufacturer, 3rd party provider at the DC, and the suppliers. Production forecasts for MTO processing units and demand forecasts for MTS peripherals needs to be shared among all parties.

3. Systems Integrators

   Much like the manufacturer in Example 2 above, Systems Integrators are required to combine multiple products from multiple sources into a single shipment to customers. Systems Integrators (SI) are found in the high tech industry, most notable mainframe computer systems, office network systems, and phone systems. In these industries, customers are ordering a system that requires all system components be delivered at the same time to an installation point. Some of the system requirements could be MTO items and some could be MTS items. Sources could be company owned or contract suppliers. However, all systems are configured to order. Figure 3 provides an example of this merge-in-transit process.

   Assume a large corporate customer orders a new phone system from a Systems Integrator. This order will require mid-range computers, software, cables, switches, and phones. The SI manufactures phones in a MTS environment, while it outsources the acquisition of the other items from 3rd parties. The computers, switches, cable, and software could be MTO or MTS, depending on the configuration of the final system. Orders are placed by the SI on its factory as well as on its suppliers for the component parts with an ATP date to the installation site already determined. As the component parts are produced/picked from stock, they are sent to a Final Integration Center (FIC), where quality checks might be performed and where the items will be temporarily stored awaiting the arrival of the last items for the system. As each item is received at the FIC, it is cross-docked to a merge area for that particular customer's system. As the last component is received, the order is closed and the complete system is sent to the installation site.

   As in Example 2, this scenario requires that information sharing and inventory visibility exist among the partners in this supply chain. It will also require the integration of the production system, order management system, and warehouse management system (WMS) to make it effective.

4. 3rd Party Logistics Providers

   The last example of merge-in-transit will examine the use of 3rd party logistics providers (3PL) for this process. This 3PL might use a DC to perform the merge or it might use a carrier's terminal network to provide the service. Figures 4 and 5 provide examples of this process.

   In Figure 4, a 3PL operates an Inbound Consolidation Warehouse (ICW) that services a manufacturing facility in a Just-In-Time (JIT) environment for component parts. The 3PL provides milk runs to suppliers on a regular schedule during the week (Note: milk runs are defined in the APICS dictionary). A milk run is a carrier service where a vehicle will pick up shipments from the same suppliers at the same time during every run. For example, Figure 4 shows 3 separate milk runs from the ICW. Supplier A's shipments will be picked up every Tuesday at 10am. This provides efficiencies for the carriers as far as routing and capacity utilization are concerned. The supplier must have access to its customer production schedules. As the components are received from the 3 milk runs at the ICW, quality checks are performed and the components are cross-docked to a sort and merge area where they start to be sequenced for delivery to the assembly line. Some short term storage might occur as the ICW will wait until the final components are received for a particular production run. In this case, all milk run receipts are merged into a single delivery to the plant to support a production run. As previously mentioned, sharing production schedules with the 3PL and suppliers is critical for this process.

Figure 5 is an example where a carrier uses its terminal network for the merge-in-transit process. This is not a process performed on truckload shipments, but on less-than-truckload (LTL) shipments. In this example, the carrier is operating 3 milk runs to suppliers A through I. The routing and timing will be dependent on the customer's ability to share order quantities with the carrier. For example, the customer will require rainbow (mixed) pallets of items A through I to be delivered to several locations. The carrier will need to know the quantities of each item to be picked up from each supplier and the availability of that item from each supplier. The carrier will also need to know how much of each item needs to be placed on the rainbow pallets for each outbound shipment. Once the items are received at the terminal (these items will usually be in bulk, i.e., straight or single item pallets), the received pallets will be broken down into individual units (usually cases) and the rainbow pallets will be constructed. This operation might require some short term storage. However, it is not designed around the storage of items. The inbound items could be either MTO or MTS. As the items are received, they are processed and cross-docked to an order picking area where the order is completed. The difference between this example and the ICW example is that this example uses a carrier's terminal network and existing milk run operation to provide the merge-in-transit. The ICW example uses a DC and customized milk runs to provide the merge-in-transit. Another difference is that the ICW operation might be designed around the storage of MTS items.

Although these examples are not comprehensive, they are intended to highlight different scenarios in which merge-in-transit can take place. All of these examples have several characteristics in common. First, merge-in-transit reduces the costs of transportation from the merge facility to the customer. This occurs simply because all items in a multiple line order are delivered in a single shipment. Second, merge-in-transit should reduce supply chain inventories. Since the concept of merge-in-transit requires that some, or all, items are merged into a single order upon receipt, the merge facility is not required to hold all items in inventory. Also, in a MTO environment, the item is not made or assembles until an order is received. Third, some or all items in an order are never stored and are merged when received from the transportation activity (hence the term, "merge-in-transit). Fourth, some or all items in an order are cross-docked to a merge area. Fifth, merge-in-transit will require less facility space because of the cross-docking process. Sixth, even though the process is called merge-in-transit, all items will come to rest somewhere in a facility (DC, plant, or carrier terminal) before being delivered to the customer. Seventh, although delivery times to customers might increase, the reliability of that delivery time will improve. Eighth, since the concept of merge-in-transit is executed in industries where customers require the delivery of all items in a single shipment, order fill and perfect order rates will improve.

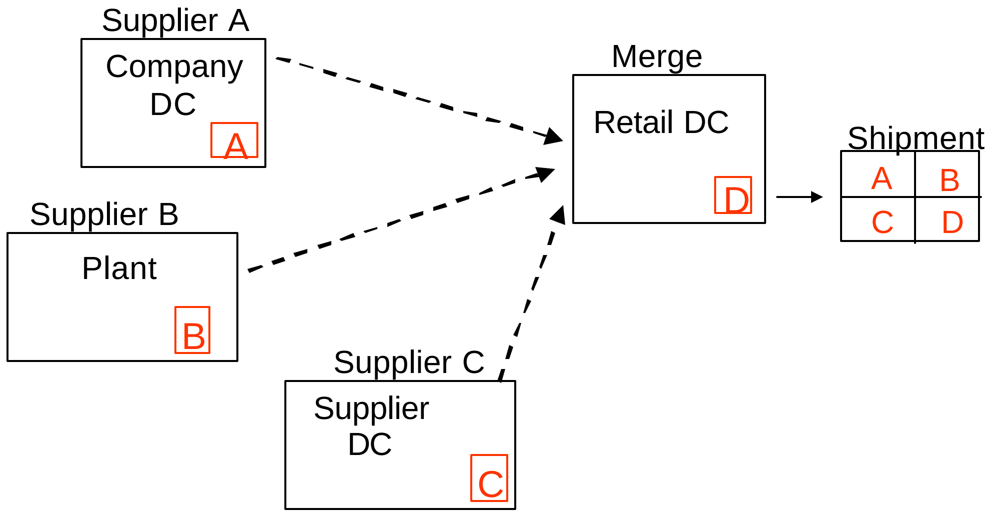
Normally, there will be a need for investments in technology, if none or little is present for all members of the supply chain (except for the customer). Merge-in-transit operations should be invisible to the customer, except for its outcome. This technology can include: bar codes, EDI, RFID or other appropriate automation enablers as agreed to by the parties involved. Information sharing among supply chain partners would include: demand/production schedules, order composition/status, and pick-up and delivery schedules.

For MTO products, the order lead-time should be greater than the manufacturing lead-time. Otherwise, the items should be manufactured and stocked prior to the shipment. The point is emphasized here to ensure that the proper business policy is adopted around defining MTO versus MTS items.

Appendix B: Best Practices

Figure 1

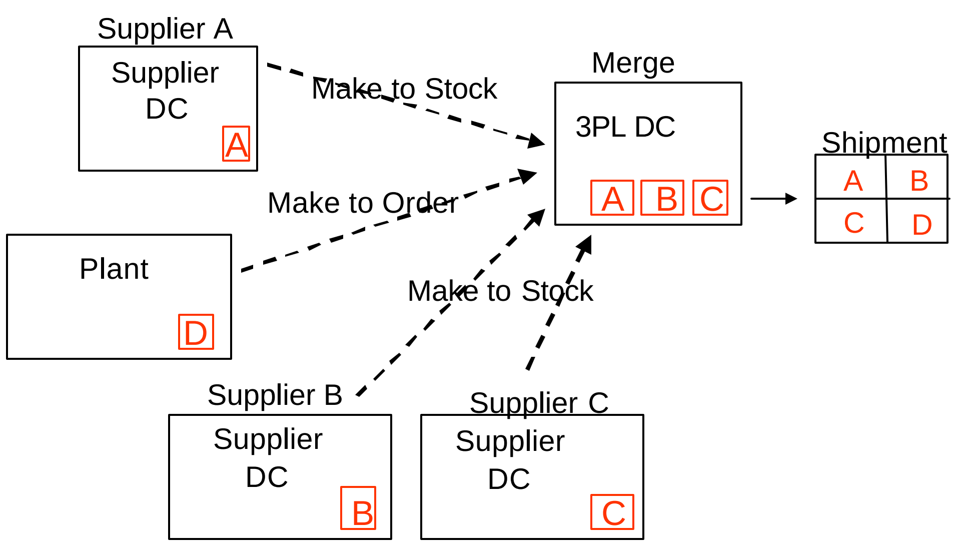
Retail Distribution Center



Center for Supply Chain Research, Penn State University, 2004

Figure 2

Manufacturing Facility



Center for Supply Chain Research, Penn State University, 2004

Appendix B: Best Practices

Best Practice: **Sales and Operations Planning**
SCOR Process Number: P1
SCOR Practice Name: Plan Supply Chain

Unique Best Practice Title: Sales and Operations Planning

BEST PRACTICE Need Indicators:

- Need to balance supply and demand across the supply chain.
- Conflicting measures and behavior in various departments
- Negative trends in:
  - fill rates
  - COGS
  - # of expedites
  - frequency of production "rush orders"
  - inventory days of supply
- Inventory unbalanced across the supply chain
- Asset Utilization below industry norms

BEST PRACTICE Definition:
APICS Online Dictionary
Sales and operations planning (C): A process to develop tactical plans that provide management the ability to strategically direct its businesses to achieve competitive advantage on a continuous basis by integrating customer-focused marketing plans for new and existing products with the management of the supply chain. The process brings together all the plans for the business (sales, marketing, development, manufacturing, sourcing, and financial) into one integrated set of plans. It is performed at least once a month and is reviewed by management at an aggregate (product family) level. The process must reconcile all supply, demand, and new-product plans at both the detail and aggregate levels and tie to the business plan. It is the definitive statement of the company's plans for the near to intermediate term, covering a horizon sufficient to plan for resources and to support the annual business planning process. Executed properly, the sales and operation planning process links the strategic plans for the business with its execution and reviews performance measurements for continuous improvement. See: aggregate planning, production plan, production planning, sales plan, tactical planning.

BEST PRACTICE Description:
Develop *coordinated* rolling monthly plans (e.g. 8-18 months in monthly periods) for the enterprise. These include plans for:

- Procurement/sourcing
- Production
- Inventory (raw materials, WIP, finished goods),
- Distribution
- Sales

From the book 'Sales and Operations Planning Handbook' by Civerolo and Rice.
"Sales and Operations Planning (S&OP) is a business management process used to

- *Establish communication links between executives and managers;*
- *Establish a common language of discussion between sales, marketing, production, and finance;*
- *Develop integrated aggregate business plans;*
- *Balance the supply of products or services with the demand for them;*
- *Provide information that executives can use to validate the business plan;*
- *Provide operating managers with information they can use to measure performance.*

Appendix B: Best Practices

S&OP does this by focusing on serving the customer's needs and matching marketplace and customer expectations with the sales plan and balancing the sales plan with the manufacturing capabilities…S&OP answers four questions:

- *WHAT is supposed to happen?*
- *WHEN is it supposed to happen?*
- *WHO is responsible for it?*
- *WHAT actually happened and why?"*

The S&OP process is not a monthly meeting or a software package module. The S&OP process is a series of actions that require involvement and supports communication." Civerolo and Rice

The goal of S&OP is to create realistic, achievable, cost effective plans, at an aggregate level for the various functional teams (e.g. Sales, Marketing, Logistics, Manufacturing, Procurement,). These aggregate plans are then refined by the respective teams to meet the detailed needs of the organization.

The S&OP process is executed on a regular basis. Normal frequencies are monthly although meetings may be held within a month to address emergency situations such as an unplanned shift in supply or demand.

Affected Supply Chain Performance Attributes/Metrics:

Attribute	Experienced Impact
Reliability	Effective S&OP plans will allocate resources such that inventory is in place at the correct locations at the correct time so that when customer orders come in they can be fulfilled within normal procedures/processes.
Flexibility	The S&OP process makes potential issues visible early, so that changes can be made to accommodate the dynamics of the supply chain. S&OP allows companies to running on lower inventory levels and thus be more flexible in their response.
Responsiveness	S&OP points out where the supply chain has lead-time issues; it raises the visibility of lead-time problems.
Costs	Significant savings in supply chain costs are realized due to lower inventory levels and more efficient use of assets. In particular, S&OP helps reduce the number and impact of expedites and "rush production orders" – both of which have a negative impact on supply chain costs. If S&OP is done well, it helps in Master Scheduling, enhancing its validity, and reduces the impact of expedites and rush orders.
Asset Management	S&OP allows an enterprise to operate much closer to target production and inventory plans (/policies). After experience with S&OP it is possible to lower safety stock levels – thereby reducing inventory levels and cash-to-cash cycle times even more. An S&OP Plan can be 'dollarized'/converted to financial terms to show the financial impact of the Plan. S&OP also helps balance workloads over time – making more effective use of current assets – and deferring (or avoiding) capital expenditures on assets.

Comments: The S&OP process helps an organization by providing extended visibility into the expected requirements and activities across the enterprise (and extended supply chain) over the planning horizon. This allows the various departments to develop more detailed plans for resources and activities to meet the anticipated requirements.

Particularly, it accounts for the capabilities and costs of each department, as well as the interdependencies in order to create plans that benefit the enterprise as a whole.

Improved enterprise-wide visibility permits efficient and effective alignment of resources to achieve the goals of the supply chain.

Effective S&OP dramatically decreases the number and impact of "surprises".

Appendix B: Best Practices

Key BEST PRACTICE Success Factors/Implementation Issues:

KSF	Comments
Technology	S&OP is essentially a PEOPLE process that can be achieved with minimal technology support. In some cases, Excel spreadsheets are adequate since the plan is at a high level (such as product families). In more complex, multi-divisional and global companies, more sophisticated software alternatives are available. Accessibility, accuracy and timeliness of aggregate enterprise-wide data are critical. Ideally strategic external data (e.g. customer forecasts, co-packer capacity/costs) would be an important asset to the S&OP process.
Policies/Procedures	S&OP is a regularly scheduled enterprise-wide process – requiring input from the many parts of the organization. Establish clear policies, procedures and clearly established accountability for all participants.
Education/ Training	Education and training is critical for the following stakeholders: 1. Top management/executives/ 'C' level: to ensure that the S&OP process is understood and embraced at this level. 2. Department heads: as participants in the (monthly) Sales and Operations Planning meeting, they provide critical input and make key decisions on balancing demand and supply. 3. Planners/Schedulers: as the recipients of the Plan, they use it to prepare and execute the Master Schedule. They also provide input to the S&OP process. There should be an acceptance that one should be "performing to plan" rather than individual performance metrics, and thus delivering better results.
Sponsors	'C" level (CEO,COO, CFO) must drive the S&OP process; in many companies this level chairs the monthly S&OP meeting. In some cases, divisional senior executives fill this role, with support by managers in procurement, production, logistics, and sales. Bottom line is that whoever is accountable for the Plan, should drive it.
Shared Vision	For maximum benefit, shared vision across the various departments is essential, with a focus on corporate goals.
Measures/Milestones/ Feedback	Key measures include: o Performance to Plan o Total Supply Chain costs o Perfect Order Fulfillment Managers should have visibility to the plans of all departments. They should also understand the impact of their deviations from plan on the other departments and the enterprise as a whole. The process should quickly identify problem areas ("exceptions"), then focus attention and decision-making on those exceptions.
Rewards/Recognition	Managers should be recognized for performance to plan.
Guidance Structure and Process	There must be a FORMAL S&OP process with policies, procedures, and accountability signed off by all appropriate managers.
Communications/Best Practice Exchange	S&OP output includes action items and associated responsibility. Minutes are recorded and distributed to appropriate personnel.

Discussion of Relative Costs of Implementation:

This practice is relatively inexpensive, in every regard, and can be implemented in two to four months.

Profile of Company where this BEST PRACTICE is most applicable:
S&OP is applicable to ANY company (manufacturing, distribution, services) that must balance demand with resources. S&OP is particularly critical in companies that face variability (or misbalance) in demand and/or supply. In particular, in cases where there are times through the year where capacity or availability is an issue. It is also more prevalent in companies that plan operations to forecasts (e.g. demand, sales, capacity, …)

Appendix B: Best Practices

Additional Comments:
Many companies do not have a highly structured, formal S&OP process. These companies would achieve significant benefits through adoption of S&OP.
S&OP is people intensive, with a heavy emphasis on teamwork and data integrity…critical elements towards a robust S&OP process that delivers results.

REFERENCES:
Sales and Operations Planning Handbook, by John Civerolo and Don Rice.

Appendix B: Best Practices

Best Practice: **Supplier (Carrier) Agreements**

SCOR Process Numbers: S1.2 / ES.2 / ES.7 / ES.9 / D1.11

SCOR Process Names: Receive Product / Assess Supplier Performance / Manage Supplier Network / Manage Supplier Agreements / Load Vehicle & Generate Shipping Documentation

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Unique Best Practice Title: Supplier (Carrier) Agreements

BEST PRACTICE Need Indicators:

- Unreliability of arrival of product, product rejection, needed excessive safety stock to compensate for unreliability of supply. (Supply side). For customers, the need was for improved customer service levels and satisfaction.
- Establishment of common expectations to establish a criteria of performance measurement

BEST PRACTICE Definition:

An agreement between The Company and domestic and global carriers, inbound and outbound, specifying service levels, payment terms, and other conditions.

BEST PRACTICE Description:

As part of a larger initiative to decrease raw material and finished goods inventory, while improving customer service, Carrier Partnership agreements were established with carriers transporting both inbound raw materials and outbound finished goods. Contractual partnership requirements would include: equipment condition, shipping condition, pick-up and delivery times, and documentation, a primary goal being Perfect Order Fulfillment. Carriers were measured, with immediate feedback and monthly formal reports. Agreements were made both with carriers that delivered raw materials to Company and with carriers that shipped products from Company to its US Distribution Center or direct to customers.

A Transportation Service Agreement is signed between The Company and all domestic and global carriers. Contract line items specify on-time delivery, plus the payment requirements for services rendered.

Affected Supply Chain Performance Attributes/Metrics:

Attribute	Experienced Impact
Reliability	An extraordinary high level of reliability was achieved. The quantitative impact was not segmented from the impact of other initiatives impacting the same metrics, although it was understood to be an essential element of the overall project to improve delivery reliability. Dropped, damaged and lost shipments do not occur frequently enough to measure. OTD figures are in the high 90's as measured by each carrier for each lane of transportation
Flexibility	Significant improvements (as above)
Responsiveness	Significant improvement in delivery to internal customer (US Distribution Center) and end customers.
Costs	Lower costs, less rejected product, faster turnaround, decrease in production downtime all were achieved, although not directly attributed to the carrier partnership portion of the initiative.
Asset Management	Less rejected product, faster turnaround, decrease in production downtime due to raw material shortages. Significant reduction in raw material and finished goods inventory.

Comments:

The implementing company did not segment the incremental increase in these metrics that resulted from Carrier Partnership Agreements since it would be difficult to do so, since there were a number of initiatives driving towards the same metric. However, significant improvements were experienced. There was a dramatic payback for minimal cost of implementation.

Every shipment, domestically and globally is measured, with summary reports provided to management every month and quarter end. OTD is considered the main measure of performance as the lack of Lost and Damaged freight is viewed as a given. By measuring all carriers, trends of performance can be seen. This provides the opportunity to replace "poorly performing" carriers with "exceptional performing."

Appendix B: Best Practices

Key BEST PRACTICE Success Factors/Implementation Issues:

KSF	Comments
Technology	None required but some carrier tracking systems could have enabled the BEST PRACTICE better (esp. from the carrier side). Continuous on line tracking of shipment would be beneficial. But, much can be gained without technology with the simple understanding between carriers and their customers. EDI, web-enabled carriers
Policies/Procedures	Yes, policies and procedures absolute must. Partnership Agreement was a clearly defined contract/document of policies, procedures, expectations. Signed by both company and carrier. Contracts for all carriers are mandated.
Training/Education	Education/orientation for company warehouse staff and anyone interfacing with the carrier needed to be familiar with the Partnership Agreement specifications. Note that these carriers could be those that deliver product to Company or those that take product to Company's customers. Have to work with individual parts of the carrier organization in certifying in steps, as reliability is established by route. Dock labor is not specifically educated on the content of the contract language, but is trained and familiar with the expectations. Supervisors and managers of operations are familiar with the carrier contracts.
Sponsors	Absolute need for Corporate Transportation group be fully on board and supportive since they assign national transportation contracts. Also required Plant Manager/Operations VP sponsorship/buy-in. Chief Logistics Officer, CEO
Shared Vision	CRITICAL first step in establishing a supplier partnership! Carriers understand that in order to be paid, they have to provide accurate billing. Also, The Company measures aging receivables to ensure that payments are made on time.
Measures/Milestones/ Feedback	As needed feedback for immediate issues. Monthly 'report card' showing compliance with established Agreement. Virtual feedback on each shipment with monthly reports.
Rewards/Recognition	Formal recognition of carriers as they were certified on basis of six months reliability/compliance to Agreement. Formal feedback on monthly performance and immediate feedback on failures to comply with specifications. The best carriers receive the greatest number of jobs. Poor performers get very little work.
Guidance Structure and Process	Agreement Definition meeting between supplier (carrier) and Company. Written statement / contract of understanding. Monitoring and reporting process established.
Quick Wins/Local Innovations	Immediate impact in dependability of supply arrivals (so production floor does not run out of product) – major shortfalls would be eliminated immediately. Rejected goods/equipment for shipping damage virtually eliminated immediately.
Communications/Best Practice Exchange	Other sites and divisions through the formal organizational management structure adopted. Initiated at the division level, the Carrier Partnership Agreement concept.

Additional Comment

The top performance of Unisys carriers is due to a thorough knowledge of the industry and the requirements of the Company, as well as the contract that is used with the carriers. Without a competent transportation manager, the contract, alone, would be of little value. The combination of trained, competent personnel and written agreements result in superior performance.

Unisys - There is a very high OTD goal, which is exceeded by almost every carrier. The typical carrier is measured at 97% to 100% performance. This is world-class performance and it is attributed to the Logistics team's competence.

Best Practices Team consensus - The value of the relationship between the Company and the carrier is the most important feature.

Profile of Company where this BEST PRACTICE is most applicable:

Any company receiving or shipping materials using common or contract carriers such as trucking, shipping, and airline companies. Also includes internal transportation providers (Company owned transportation group).

Appendix B: Best Practices

<u>INDUSTRY RESEARCH:</u>
Recently conducted research across a wide variety of business categories reveals that companies that treat their suppliers as partners have measurable financial benefits.

In its 2003 study, "Negotiating and Managing Key Supplier Relationships," consulting firm Vantage Partners looked at the benefits of applying relationship management processes and metrics to supplier relations. The study of 114 companies found that:

1. When asked how much more value (in terms of cost savings, innovation, quality, etc) is delivered by suppliers with whom a company has a strong working relationship verses suppliers with whom the company has a poor working relationship, almost half of the respondents said that strong working relationships deliver at least 50% greater value than poor ones.

2. Procurement professionals also stated that they could improve their company's bottom line by realizing savings of $43 million annually through the application of strategic relationship management tools and processes to key supplier relationships. Respondents who stated their answer with the most confidence, reported that on average, they could save almost $56 million to their bottom line.

3. "Traditionally, procurement has focused on saving money. Particularly in a weak economy, many companies have attempted to wring out cost savings by rationalizing their supply base and concentrating volume to gain price leverage," says Los Angeles-based Larraine Segil, a partner at Vantage Partners. "However, companies have recently begun looking at procurement more strategically, as a means to gain competitive advantage."

The Vantage study culled responses from aerospace/defense, business services, construction/finance/insurance/real estate, health-care services, leisure and entertainment services, manufacturing, mining/oil, pharma/biotech, retail/wholesale, transportation, education and utilities.

Vantage reports that in order to achieve greater profitability and gain a competitive edge, many companies are partnering with their suppliers, borrowing elements of the Japanese keiretsu model, which emphasizes integration, long-term relationships and joint gain. Such relationships are characterized by a high level of trust, mutual respect, open and efficient communication, shared risks and rewards, commitment to each other's success and the ability to constructively deal with differences.
Source: Industry Week

Appendix B: Best Practices

Best Practice: **Vendor Managed Inventory (VMI)**
SCOR Process Numbers: P1 / P2 / P4 / S1.1 / S2.1 / S3.3 / ES.7 / D1 / D1.5 / D1.6 / D2.5 / D2.6 / D3.5 / D3.6
SCOR Process Names: Multiple Plan, Source and Deliver Processes

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Unique Best Practice Title: VMI, Vendor Managed Inventory

BEST PRACTICE Description:
The APICS Dictionary (10th edition) defines VMI as "A means of optimizing supply chain performance in which the supplier has access to the customer's inventory data and is responsible for maintaining the inventory level required by the customer. Re-supply is performed by the vendor through regularly scheduled reviews of the on-site inventory. The on-site inventory is counted, damaged or outdated goods are removed, and the inventory is restocked to predefined levels."

In his article "Simplicity is Key," David Jessop explains VMI: "The supplier takes responsibility for the operational management of the inventory within a mutually agreed framework of performance targets, which are constantly monitored and updated to create an environment of continuous improvement."

It is important to emphasize that different "styles" of VMI agreements exist. Entering a VMI agreement can be a big step for a each partner, with mutual risks and mutual opportunities.
VMI styles can include:

- Re-supply need not be on a scheduled basis (e.g. it can be more flexible to occur within certain conditions – e.g. any day normal business hours)
- The customer could be included in the 'approval' process – e.g. the vendor could propose a replenishment (quantity, date) and the customer has to explicitly (or implicitly) approve the order.
- Transfer of ownership of inventory can differ from one VMI agreement to the next.
- 'Pay on Use'- implies transfer of ownership when the inventory moves into the other party's facility; with payment on use. –The user initiates a payment on fixed terms.

NOTE: Consignment is not VMI: With consignment, title is not transferred -when the purchaser resells the item, payment is initiated on this re-sale.

VMI is often associated with other best practices such as CPFR, KanBan, Point of Use stocking, and others.

VMI usually involves shared benefits, with one partner reaping more benefits than the other on one metric, with the other partner finding greater benefits in another metric. Some benefits are mutual; some are one-sided.

Appendix B: Best Practices

Affected Supply Chain Performance Attributes/Metrics:

Metrics in each of the SCOR attributes are affected by VMI, with the major impacts on Reliability, Responsiveness, Costs, and Assets. The extent of the effect will vary depending on the type of VMI agreement and the associated details. Each partner may/may not share equally in the benefits and, in some cases, there may need to be a decision on metric trade-offs.

Attribute	Experienced Impact
Reliability	For some companies, VMI helps to assure the availability of items thereby helping to ensure better on-time delivery performance as well as greater fill rates.
Flexibility	For companies with item availability issues, VMI can help to improve availability, thereby impacting the response time equation, especially when long lead items are under VMI.
Responsiveness	Less time is spent waiting for items, allowing the production to operate more smoothly and quickly. With visibility of the demand cycle, you can agree to an official lead time, which can be reduced, and be predictable. Kraft, for example, realized a 15-20% reduction in lead times.
Costs	From the manufacturer's side, material overhead is reduced due to lower inventory levels needed to maintain production demand, thereby reducing costs. Accuracy and predictability of the demand signal improves these Cost metrics since there is an increase in planning time. However, there may be tradeoffs in metrics. The Vendor, if specified in the agreement, gets a clear view of the demand cycle and can lower variable manufacturing costs (when rescheduling production, vendors have the latest demand signals from their customers).
Asset Management	Note that VMI transfer of ownership of inventory and/or payment terms will vary depending on the agreement. VMI involves a focus on working capital, with the goal being a win-win situation with both parties experiencing a working capital reduction. The contribution to these metrics will vary depending on the type and details of the agreement.

Appendix B: Best Practices

Key BEST PRACTICE Success Factors/Implementation Issues:

KSF	Comments
Technology	Specific capabilities must be in place for VMI to succeed. These include: ▪ Electronic commerce infrastructure ▪ Forecasting capability ▪ Replenishing capability ▪ Load building/order creation ▪ Reporting capability Since technology can support these capabilities in a more effective and efficient way than a manual manner, the addition of technology such as ERP and SCM applications will enhance these capabilities and hence the success of the VMI initiative. Access to data such as inventory levels and usage rates is essential to a successful VMI program. VMI works very well in conjunction with CPFR – Collaborative Planning, Forecasting and Replenishment. By understanding the customer's future requirements the benefits of VMI to both parties can be maximized. VMI can be implemented both manually or aided by technology. Adding technology increases the complexity and cost of implementation. For example, agreements have to be made in regards to synchronization and timing of transmissions. Depending on the company size, # partners and # items involved in the VMI agreement, technology may be a prerequisite. In most VMI programs, technology plays a major role.
Policies/Procedures	Well-defined VMI agreements are a MUST. Note that there may be a greater or lesser impact on contractual agreements between the partners when a VMI agreement is in place (depending on the VMI variation) such as performance, frequency of deliveries, transfer of ownership rules, payment, etc. Some important aspects of policies and procedures include: ▪ a trustful partnership ▪ periodic review structure/project structure to monitor, revisit agreements, ▪ full information sharing: ▪ Customer's existing inventory disposition policies at the onset of VMI contract (how the existing inventory will be handled) ▪ Operating cost of maintaining the inventory at the customer location (e.g. labor cost) ▪ Upfront analysis of critical and non-critical parts.
Training/Education	Varying levels of education and training at both parties to the agreement, including awareness training of what VMI is, VMI goals, metrics, and how it works. Other training often included: Inventory management, electronic commerce, application training.

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KSF	Comments
Shared Vision	As a highly collaborative agreement a negotiated shared vision is a necessity. This agreement would include clarification of: ▪ Goals ▪ Confidentiality ▪ Types of info sharing ▪ Business functions and roles/org mapping to roles and responsibilities. ▪ Issue resolution process ▪ Win-Win features ▪ Review cycle
Sponsors	Procurement and Sales management, particularly upper management.
Measures/Milestones/Feedback	A before and after VMI analysis is essential to understanding VMI value. Advanced notice of future requirements is essential feedback. Performance reports should be published at agreed upon intervals (weekly, monthly).
Rewards/Recognition	Rewards – periodic review with recognition of wins. Suppliers need to know the perceived performance by the customers.
Guidance Structure and Process	There should be a well-defined project plan with provisions for monitoring the program. Using experienced applications providers helps to support implementation of VMI It helps if one of the partners has prior VMI experience.
Quick Wins/Local Innovations	Like many new process implementations, a small, local success helps in institutionalizing and in selling the program. A part of the trial implementation should be a cost analysis. It may be that organizational competencies are so good that VMI will reduce performance. Some companies are investigating reducing VMI for ordering their own parts, due to cost considerations. (Paul – we did not discuss this – I have some questions with this statement. practitioners on Thursday
Communications/Best Practice Exchange	Success with VMI is directly proportional to the ability of partner organizations to collaborate.

<u>Discussion of Relative Costs of Implementation:</u> Oftentimes VMI costs are only those associated with establishing an agreement between buyer and seller. With experience, it can be completed quickly. Parties sometimes disclose costs of implementation with their partner. Cost varies depends on scope and depth and level of technology.

<u>Profile of Company where this BEST PRACTICE is most applicable:</u>
Any set of trading partners involving physical items. Highly scaleable – prioritize your partner involvement based on win-win potential, and other circumstances.

<u>Additional Comments:</u>
The cost of implementation is dependent upon the scope and whether or not major B2B applications such as ERP or SCM applications are needed.

Appendix B: Best Practices

Glossary:
B2B – Business-to-Business commerce
ERP – Enterprise Resource Planning
SCM – Supply Chain Management
LTL – Less than Truckload
EDI – Electronic Data Interchange
DSO – Days Sales Outstanding
A/P – Accounts Payable
Kan Ban – Ticket used to demand component in Pull manufacturing system
Point of Use – Stocking technique whereby components are delivered to precise location where the component is used.
CPFR© -Collaborative Planning Forecasting and Replenishment (guidelines issued by VICS (Voluntary Interindustry Commerce Standards Association)

Additional Reading/Resources:

1. http://www.cpfr.org/documents/ppt/VMI_vs._CPFR.ppt 'VMI vs. CPFR®'

2. http://www.cpfr.org/documents/pdf/Whats_The_Difference_VMI_CoManaged_Inventory_CPFR.pdf "What's the Difference: VMI, Co-Managed Inventory, CPFR®?

Appendix B: Best Practices

Best Practice: Wave Picking

SCOR Process Number: D1.9
SCOR Process Name: Pick Product

Unique Best Practice Title: Wave picking

BEST PRACTICE Need Indicators:

- Low distribution center (DC) labor productivity
- High DC order pick costs
- High transportation costs

BEST PRACTICE Definition/Description:
Wave picking is a practice used in many DC operations to increase labor picking productivity and reduce the labor cost per pick. In some DC's, orders are scheduled to be picked when they are received. Wave picking consolidates orders into "waves" where multiple orders with similar characteristics are picked at one time. Orders can be consolidated by customer, geography, or any other criteria that makes sense for the DC operation. In an operation where freight consolidation for shipping is important, wave picking can help consolidate less-than-truckload (LTL) shipments into truckload (TL) shipments.

Many times wave picking is performed in conjunction with batch picking. Batch picking aggregates similar items across orders into a single pick. For example, assume that the DC has 15 orders each containing Item A. In a single order pick environment, the order picker would make 15 separate trips to the location containing Item A. In batch picking, the order picker would make 1 trip to the location of Item A and pick 15 units. Most wave picking attempts begin with small batch picking initiatives. The combination of batch and wave provides the most productivity. Wave picking does not have to incorporate the batch picking process. Wave picking can also be single order pick. The idea of waves is to pick many orders all at one time versus as they are received at the DC. Wave picking, in conjunction with batch picking, increases the total travel time for each order picker, but the total time per item picked is reduced. This also allows the DC more flexibility when scheduling its order picking crew. If multiple waves are picked during the day, care must be taken to balance the number of orders across each wave as equally as possible. Waves can be planned based upon the estimated time required to complete the wave. For example, if picker productivity is 120 units per hour and the shift consists of 10 pickers, the system can release work in 1 hour blocks to make management more efficient. This makes the operation more predictable and measurable.

Efficient wave picking requires some type of Warehouse Management System (WMS) software to prioritize orders and allocate them to an appropriate wave. This practice also requires some type of interface with the firm's order management system and its Transportation Management System (TMS). Batch picking is best accomplished with an integrated sortation device that takes the results of the batch pick and creates individual orders. This is more costly from a capital investment perspective but greatly reduces operating cost and increases the consistency of throughput.

Delivery times to customer might increase. Depending on the duration of the waves picked and the number per day, the consolidation of orders into waves requires holding them for a period of time before they are picked. The result is that the first order received into a wave waits the longest to be picked. However, delivery times should become more consistent since pick times and ship times can be more easily scheduled. Also, usually orders received today will be shipped today since full TL quantities can be consolidated more quickly than in single order pick. Optimal wave planning will facilitate these results. Waves must match the business environment for which they are being planned. Direct-to-consumer businesses might schedule waves specific to days of delivery or might have a "clean-up" wave to catch all next day orders not waved throughout the day.

Wave picking increases DC picking and shipping productivity substantially. If managed appropriately, customers should receive more consistent deliveries. Wave picking can increase order fulfillment accuracy as well since there are fewer opportunities to mis-pick product.

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Affected Supply Chain Performance Attributes/Metrics:

Attribute	Experienced Impact
Reliability	Cycle time might increase but should become more consistent
	If cycle time is a component, POF might go down but become more consistent
Flexibility	Supply-chain Response Time might decrease because throughput will increase.
	Offers substantial opportunities for DC in scheduling labor and shipping schedules
Responsiveness	Order Fulfillment Lead Time might decrease because throughput and capacity utilization will increase.
Costs	Total SCM Cost will go down because of decreasing DC labor costs, transportation costs, and possibly decreasing inventory costs.
	Cost of Goods Sold might decrease if inventory accuracy increases.
	DC labor becomes more productive at picking and shipping
Asset Management	Cash-to-Cash cycle Time could go down if lead times are reduced.
	Inventory Days of Supply might go down since inventory velocity should increase during waves
	Asset Turns will increase for transportation vehicles and might increase because of increased inventory velocity

Comments:

These are DC measures. Suppliers are usually not impacted by wave picking.
Inventory velocity measures how quickly inventory is moved through the DC. Many times the common measure of inventory velocity is inventory turns, which is a measure of cash movement. Little's law defines the relationship between inventory velocity and inventory levels: As the velocity of inventory increases through the supply chain, supply chain inventories decrease, and vice versa.

Inventory accuracy might increase because of a reduction in overall handling of the inventory, especially in the pick location. Fewer opportunities for mis-picks and over-picks occur. Replenishment is critical because inventory must be present in the pick location in order for the wave to proceed. Additionally, if replenishment is late to a pick location it might cause an unnecessary cycle-count to occur to rectify the lack of synchronization.

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Key BEST PRACTICE Success Factors/Implementation Issues:

KSF	Comments
Technology	This practice requires the use of some type of WMS at the DC. Preferably, bar codes and Radio Frequency (RF) scanning technology in the pick areas will allow the waves to be more productive. The WMS will need to interface with the DC's order management system and TMS. Batch wave picking is greatly enhanced with the addition of automatic sortation devices. The "RF" technology mentioned here is existing technology consisting of hand-held radio frequency scanners using traditional bar codes. The RF here does not refer to RFID (radio frequency identification), although this could be an enabling technology for this process.
Policies/Procedures	Strong customer relationships are necessary. Acceptable lead times must be defined between the DC and its customers. This will facilitate the allocation of orders into waves. Also, internal business rules must be in place to handle exceptions.
Training/Education	Training of DC workers is necessary to implement the wave picking process. Also, training will be required for sortation as a result of the batch picking process. Training on exception management is also critical.
Sponsors	Upper management at both the DC and the customer are required as sponsors since lead times to customers might be impacted.
Shared Vision	Since this is a collaborative relationship between a DC and its customers, a shared vision of the following is required: • goals • types of information sharing • understanding of roles and responsibilities • risk/reward results • review periods
Measures/Milestones/ Feedback	An analysis needs to be undertaken to understand the impacts of wave picking at both the DC and customer locations for: labor productivity, shipping productivity, asset productivity, and lead time. Usually, customers will generate quarterly compliance reports on the DC's performance.
Rewards/Recognition	Implementing wave picking without adversely impacting lead time will result in the DC being recognized as a preferred shipping point. DC productivity improvements are major KPI's in most organizations.
Guidance Structure and Process	A detailed plan for implementation should be developed. Many organizations have Centers of Excellence for best practices that help implement new processes at DC's.
Quick Wins/Local Innovations	Most implementations begin with a small group of customers or geographic locations. Normally, these groups should provide some level of stable demand.

Comments:
Possible implementation difficulties might include:

1. Because orders are held for consolidation into pick waves, some customers might see increased lead times. Shortening the wave duration might alleviate this. However, care must be taken to build customer delivery requirements into wave planning.
2. Efficient management of dock doors: the volume of orders entering the shipping area during a wave will increase. As such, dock congestion must be avoided by implementing efficient loading processes.

Discussion of Relative Costs of Implementation:
Usually requires some investment in technology at the DC if none or little exists. This would include, but not be limited to: WMS, bar code technology, RF scanner capability, automated order handling material equipment (could be pallet jacks, fork trucks, and/or conveyor systems). Customers usually do not incur any increase in investment or operating costs. However, wave picks can be done in smaller DC's with smaller volumes utilizing mostly manual labor. Some type of sort and segregate technology would still be appropriate here, although at a relatively lower investment.

Profile of Company where this BEST PRACTICE is most applicable:
Most commonly found in the retail, high-tech, and small parts industries. Ideally suited for environments where many customers place large numbers of similar orders. Mostly seen in environments where demand is fairly stable throughout the operating period. This practice can also be used where seasonality temporarily increases volume in a DC. Can be

used in a single item pick, inner pack pick, or case pick environment. Would not be as practical in a pallet pick environment. Works well with multiple line orders that are usually LTL in nature. However, works best with single line orders with the same SKU going to multiple customers. Automated picking and conveyor systems make this practice more efficient. Frequently seen in the retail sector where a single DC has many shipping locations, each receiving a similar product mix. Most commonly seen in situations where DC operations are critical to an organizations success in terms of cost and/or service.