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Supply Chain Management (SCM) Systems.

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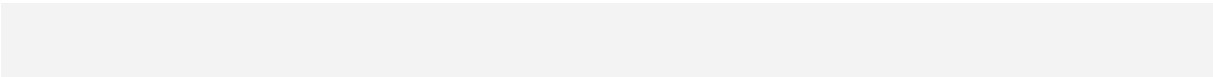


Table of Contents

Chapter 4 Supply Chain Management (SCM) Systems	3
4.1 Definition	3
4.2 Supply Chain Management Systems - processes, flows, and characteristics	4
4.3 SCM problems	6
4.4 SCM systems	7
4.4.1 SCM Characteristics	7
4.4.2 Supply-Chain Operations Reference-model (SCOR)	9
4.4.3 Oracle SCM	12
4.4.4 SAP Supply Chain Management	13

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Online resources - interactive courses on SCM at <http://www.acm.org>

1. Supply Chain Management
2. The Fundamentals of Supply Chain Management

Chapter 4 Supply Chain Management (SCM) Systems

4.1 Definition

The supply chain can be defined „as a network of suppliers, manufacturers, distributors, retailers, and customers that are linked by information, wares, and capital that move among the participants.”¹

Supply chain management (SCM) is the conduct of the interrelated elements among the supply chain's functions, like procurement, logistics, and inventory management, as well as the interactions between the firm and outside companies within the supply chain.

In a general context, SCM can be defined as „the systematic, strategic coordination of traditional business functions and the tactics across these business functions within a particular company and across these businesses within the supply chain, for the purposes of improving the long-term performance of the individual companies and the supply chain as a whole”.¹

Supply chain management is „the close linkage and coordination of activities involved in buying, making, and moving a product.”²

American Production and Inventory Control Society (APICS, 1998) gives to SCM the following definitions:

- „The processes from the initial raw materials to the ultimate consumption of the finished products linking across supplier-user company”;
- „The planning, organizing, and controlling of supply chain activities.”

The notion of supply chain management (SCM) emerged around the 1960s, with more attention being paid to the subject into the 1980s, although the popularity of SCM did not really take off until the 1990s. Up until this time, the predominant model for a company's supply chain was very company-centric, with little involvement from suppliers and customers. A good example of this is the development of a model combining supply chains understandings and operations research.

In the mid 1990s, consultants at Pittiglio Rabin Todd & McGrath (PRTM) sensed the need for a model that would help illustrate, and thus improve, the way companies in a supply chain work together. The result of their efforts and input from more than 75 manufacturers and the Advanced Manufacturing Research (AMR) firm was the Supply Chain Operations Research model (SCOR). Those 75 companies created an association called the Supply Chain Council (SCC) to further these efforts.

Successful companies such as Wal-Mart, Dell, Best Buy, Procter & Gamble, and Volkswagen are all managing their supply chains in ways that allow these companies to compete more effectively in their relevant marketplaces. Supply chain management is increasingly seen as a source of competitive advantage for companies, and this area of competition is expected to be further leveraged in coming years.

¹ Business and Competitive Analysis: Effective Application of New and Classic Methods by Craig S. Fleisher, Babette E. Bensoussan, FT Press, 2007

² Kenneth & Jane Laudon – Essential of Management Information Systems, Fifth Edition, Prentice Hall, Pearson Education International, 2003

Supply chain management refers to “the process of managing materials from buying supplies through distributing products”.

Supply chain management systems are very complex and cover cost analysis, inventory management, warehouse management, purchasing and procurement, replenishment and re-supply, distribution, and transportation functions.

4.2 Supply Chain Management Systems - processes, flows, and characteristics

The supply chain is a network of organizations and business processes for procuring materials, transforming raw materials into intermediate and finished products, and distributing finished products to customers. It links (figure 4.1) suppliers (a multitiered net of primary, secondary, and tertiary suppliers), manufacturing plants, distribution centers, conveyances, retail outlets, people, and information through processes such as research and development, procurement, operations, inventory control, distribution, communication, and delivery to supply goods and services from source through consumption.

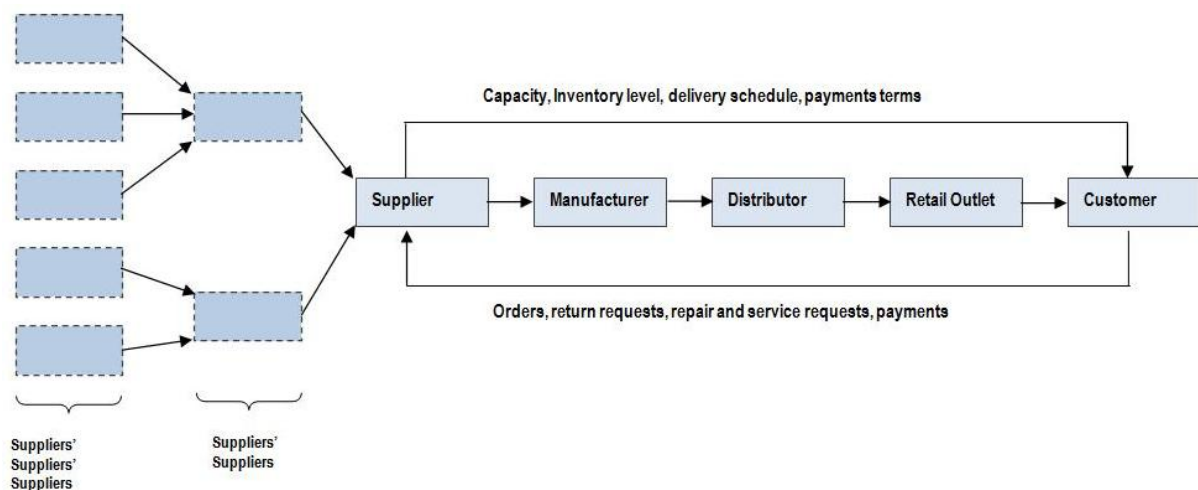


Figure 4.1 Supply chain management (Source: Kenneth & Jane Laudon – Essential of Management Information Systems, Fifth Edition, Prentice Hall, Pearson Education International, 2003)

The roles played by the actors implied into the supply chain depicted in figure 4.1 are:

- The *supplier* provides the raw materials and/or parts to a manufacturer;
- The *manufacturer* transforms the raw material and/or parts into a finished product;
- The *distributors* logistically warehouse and transport finished products to retailers;
- The *retailers* purchase finished products with the intent of reselling these goods to customers;
- The *customers* are the consumers who purchase finished products from the retailers.

The processes into the supply chain can be divided into three major flows of activity, which must be managed among all the components of the chain, as follows:

- **Internal**, grouping functions that generally includes processes that take the input from the supplier network and transform it into the output for that industry;
- **Upstream**, the supply of goods from the supply network is called the *upstream flow*, and accordingly the functions that support that flow are categorized here;

Downstream, the distribution channels are identified as the *downstream flow*, and accordingly the functions that support that flow are categorized here.

The external upstream portion of a supply chain includes suppliers and managing the external upstream flow from the supplier network ensures that the right materials arrive at the right location at the right time.

The external downstream portion of a supply chain includes distributors and retailers involved in the distribution of finished products to the end customer.

By sharing this data "upstream" (with a company's suppliers) and "downstream" (with a company's clients), SCM applications have the potential to improve the time-to-market of products, reduce costs, and allow all parties in the supply chain to better manage current resources and plan for future needs.

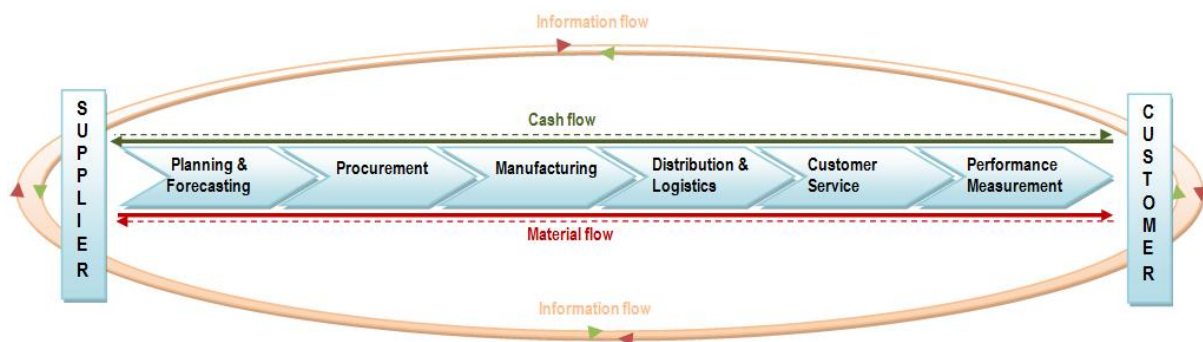


Figure 4.2 SCM internal activities and flows

Supply chain management flows can be divided into three main flows:

- The **information/data** flow that acts as a „backbone“ allowing sharing all required information/data (this information flow involves not only transmitting orders and updating the status of delivery, but also all required information for an effective and efficient collaboration);
- The **raw material/product** flow includes the movement of goods from a supplier to a customer, as well as any customer returns or service needs (the dashed line suggests the return of goods);
- The **financial** flow consists of credit terms, payment schedules, and consignment and title ownership arrangements, as well as any cash returns.

All organizations are members of one or more supply chains that vary in size and function.

In a supply chain, each component must develop and deliver a product to a company's customers, each one component depends on the others for success, and all components must work together (collaborate) to successfully develop and deliver a product to customer. Supply chain management is designed to manage the flow of activity among the components of the chain, with an ultimate goal of reducing supply chain costs. Being part of the same chain they have in common at least one objective that requires collaboration, measurement, and coordination of these. Supply chain collaboration can be divided into two segments:

- **Organizational** that occurs within a single company;
- **Inter-organizational** that occurs among the companies that make up the supply chain and have the following main results:

1. *Increased integration of the entire supply chain* that is obtained mainly by sharing required data in real-time, for example, communicating the customers' needs to all members of the entire supply chain;
2. *Improved customer service* that is obtained by integrating processes and sharing information across the supply chain which result in adding value to the customer's experience with the particular product or service.
3. *Reduced supply chain costs* by streamlining the processes and removing duplication, operating costs are lowered.

An effective supply chain will ensure that the right goods get to the right people, in the right place, at the right time, into the right quantities, at minimal cost, and maximum efficiency to the company. To accomplish this, the supply chain management system must have the following two characteristics, flexibility and coordination, as follow:

1. **Flexibility** – the organization's ability to respond to changes in the environment, including changes in market demand (it includes having the ability of estimating the final customer demand of a product [forecast market demands] and change output based on that). The concept of flexibility involves two elements:
 - **Customer driven** - Consumers drive the market.
 - **Adequate inventory** – maintained at profitable level by changing the output based on the forecast outcomes.

Flexibility requires that the organization use forecasting data (What the final demand for a product will be?) or real-time information (this trend replace forecasting) to determine production goals.

2. **Coordination** - after deciding to output a product based on market demand, a company will begin coordinating its processes, both within its organization and across its supply chain, to provide accurate lead times, ensure on-time deliveries, and maintain accurate inventory levels. Coordinating a system requires tools and processes that enable collaboration among the partners, suppliers, customers, and companies connected within a supply chain.

Supply chain strategies can be divided into two categories:

- **Strategic** - a long-term set of goals and initiatives that aligns with the corporate strategy;
- **Operational** - a set of short-term goals that focus on the day-to-day decisions.

There are four areas in supply chain management - location, production, inventory, and transportation - that require decisions, strategic and operational, to be made:

- **Location** - define production, stocking, sourcing points, and possible paths of product flow. They are strategic in nature and outlines how to access the market and impacts revenue, cost, and level of service.
- **Production** - are operational strategies that define the types of products to be produced (the day-to-day tasks are mapped, including production schedules, workload balancing, and quality control measures affecting revenue, costs, and customer service).
- **Inventory** - are operational strategies including deployment and control policies that determine optimal levels of order quantities, reorder points, and safety-stock levels - since inventory exists at every stage of the supply chain.
- **Distribution** - with both types strategies: strategic, when determining how to ship, and operational, when determining the shipping schedules.

4.3 SCM problems

As we specify in the first paragraph, supply chain management systems are very complex and cover cost analysis, inventory management, warehouse management, purchasing and procurement, replenishment and re-supply, distribution, and transportation functions. In this context managing the supply chain is an extremely complicated task, which requires correct coordination of distributed heterogeneous information. Each part of the chain plays a different role in the functionality of the entire chain and it is difficult to conceive a suitable model, especially when the latter is designed to be more generic rather than to describe a particular chain. A chain is as strong as his weakness link. The chain can become weak when influenced by negative factors from which bullwhip effect and bad coordination are very important.

Bullwhip Effect. The information about the demand for a product gets distorted as it passes from one entity to the next across the supply chain. A slight rise in demand for an item might cause different members of the supply chain – distributors, manufacturers, suppliers, suppliers’ suppliers, and suppliers’ suppliers’ suppliers (figure 4.1) – to stockpile inventory so each has enough „just in case”. These changes will ripple throughout the supply chain, magnifying what started out as a small change from planned orders, creating excess inventory, production, warehousing, and shipping costs. The variance of orders amplifies upstream the supply chain. Bullwhip effect can be minimized if all divisions of the supply chain work as a team and share dynamically information about inventory levels, schedules, forecasts, and shipments they would have a more precise idea of how adjust their sourcing, manufacturing, and distribution plans. Information sharing and, more generally, coordinating information and planning along the supply chain can minimize the bullwhip effect.

Coordination. An incorrect coordination will have a bottleneck effect - the products are accumulated in one part of the chain, while there is a shortage at its end. This can lead to products eventually becoming useless, or can force a modification of the manufacturing and supplying process, with immediate impact on product quality, cost and competition. The following are examples of how to enhance coordination within an organization:

- Remove redundancy from supply chain processes;
- Enhance collaboration using technology;
- Share information in real time, via the Internet;
- Use scheduling and advance planning software;
- Develop relationships with supply chain members.

4.4 SCM systems

4.4.1 SCM Characteristics

SCM systems fall under the manufacturing category, but are often treated as a separate function because of their complexity. Supply chain management refers to the process of managing materials from buying supplies through distributing products. These systems are very complex and cover cost analysis, inventory management, warehouse management, purchasing and procurement, replenishment and re-supply, distribution, and transportation functions. SCM systems provide a real-time graphical view of where materials are in the manufacturing process and can cover multiple work sites. Companies use supply chain

software to control costs associated with maintaining large inventories, and some, in fact, would like to operate with zero inventory, bto (build to order).

Supply chain processing can be very complex because it requires communication with many different companies—all the companies that provide the supplies for the manufacturer to produce their own product. Some supply chain software provides a multi-company interface over the Internet.

According to Kenneth & Jane Laudon, supply chain management systems fits into two broad categories: supply chain planning and supply chain execution.

Supply chain planning systems enable the firm to generate demand forecasts for a product and to develop sourcing and manufacturing plants for that product. Capabilities of such systems include:

- *Order planning* – select an order fulfillment plan that best meets the desired level of service to the customer;
- *Advanced scheduling and manufacturing planning* – provide detailed coordination of scheduling based on analysis of changing factors and create job schedules for the manufacturing process and supplier logistics;
- *Demand planning* – generate demand forecasts from all business units using statistical tools and business forecasting techniques;
- *Distribution planning* – create operating plans for logistics managers;
- *Transportation plans* – track and analyze inbound and outbound movement of materials and products to ensure that materials and finished goods are delivered at the right time and place at the minimum cost.

Supply chain execution systems manage the flow of products through distribution centers and warehouses to ensure that products are delivered to the right locations in the most efficient manner. Capabilities of such systems include:

- *Order commitments* – allows vendors to quote accurate delivery dates to costumers;
- *Final production* – organize and schedule final subassemblies required to make the final product;
- *Replenishment* – coordinate component replenishment so that warehouses remains socked with the minimum amount of inventory in the pipeline;
- *Distribution management* – coordinate the process of transporting goods from the manufacturer to distribution centers to the final consumer;
- *Reverse distribution* – track the shipment and accounting for returned goods or remanufactured products.

4.4.2 Supply-Chain Operations Reference-model (SCOR)

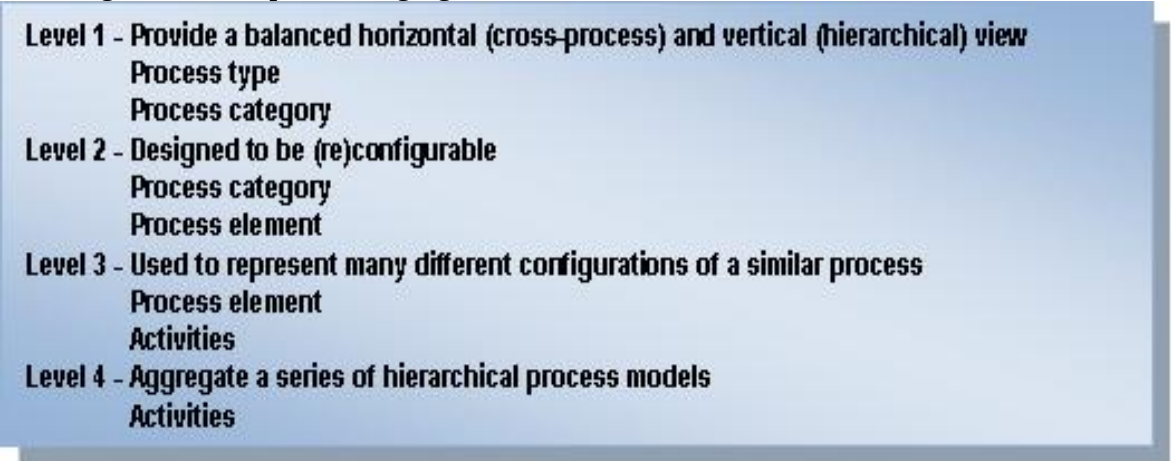
The Supply-Chain Operations Reference-model (SCOR) is a process reference model that has been developed and endorsed by the Supply-Chain Council (SCC) as the cross-industry standard diagnostic tool for supply-chain management. SCOR enables users to address, improve and communicate supply-chain management practices within and between all interested parties.

SCOR is a management tool. It is a process reference model for supply-chain management, spanning from the supplier's supplier to the customer's customer. The SCOR-model has been developed to describe the business activities associated with all phases of satisfying a customer's demand. By describing supply chains using 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.

The SCOR model looks at SCM from a strategic, rather than operational or design perspective and should therefore be more helpful to analysts looking to analyze SCM for business and competitive purposes.

The SCOR model helps executives see their part in the bigger chain by shifting the format away from the traditional supplier/manufacturer/customer perspective to five management processes (figure 4.4) that each company must undergo in each link of the chain. Planning is the first of the five processes and is central to managing the other four processes, which are source, make, deliver, and return. Every time there is an exchange of goods between parties, all five processes are utilized. The SCOR model identifies three levels of process detail (figure 4.3). Level I is the top level and deals with process types (SCOR Version 9.0 overview). It outlines (defines the scope and content) the SCOR model and sets basis of competition performance targets.

Level II deals with process categories. The process categories are the basis for the supply chain to be custom configured, which in turn provides a format for the company to execute their operations strategy. Level III deals with process elements and is the level at which processes are developed, articulated, and translate into competencies. Best practices, performance metrics, and the necessary systems for support are articulated at this level. Level IV and lower refers to activities and defines specific practices to achieve competitive advantage and to adapt to changing business conditions.



Level 1 - Provide a balanced horizontal (cross-process) and vertical (hierarchical) view
Process type
Process category
Level 2 - Designed to be (re)configurable
Process category
Process element
Level 3 - Used to represent many different configurations of a similar process
Process element
Activities
Level 4 - Aggregate a series of hierarchical process models
Activities

Figure 4.3 SCOR processes stack

The model emphasizes that all processes must be planned and gives a collaborative tool to aid communication because all components of the chain are visible, as is the flow of information and materials.

SCOR is Based on Five Distinct Management Processes³

Plan	Demand/Supply Planning and Management - Balance resources with requirements and establish/communicate plans for the whole supply chain, including Return, and the execution processes of Source, Make, and Deliver. - Management of business rules, supply chain performance, data collection, inventory, capital assets, transportation, planning configuration, regulatory requirements and compliance, and supply chain risk. - Align the supply chain unit plan with the financial plan.
Source	Sourcing Stocked, Make-to-Order, and Engineer-to-Order Product - Schedule deliveries; receive, verify, and transfer product; and authorize supplier payments. - Identify and select supply sources when not predetermined, as for engineer-to-order product. - Manage business rules, assess supplier performance, and maintain data. - Manage inventory, capital assets, incoming product, supplier network, import/export requirements, supplier agreements, and supply chain source risk.
Make	Make-to-Stock, Make-to-Order, and Engineer-to-Order Production Execution - Schedule production activities, issue product, produce and test, package, stage product, and release product to deliver. With the addition of Green to SCOR, there are now processes specifically for Waste Disposal in MAKE. - Finalize engineering for engineer-to-order product. - Manage rules, performance, data, in-process products (WIP), equipment and facilities, transportation, production network, regulatory compliance for production, and supply chain make risk.
Deliver	Order, Warehouse, Transportation, and Installation Management for Stocked, Make-to-Order, and Engineer-to-Order Product - All order management steps from processing customer inquiries and quotes to routing shipments and selecting carriers. - Warehouse management from receiving and picking product to load and ship product. - Receive and verify product at customer site and install, if necessary. - Invoicing customer. - Manage Deliver business rules, performance, information, finished product inventories, capital assets, transportation, product life cycle, import/export requirements, and supply chain deliver risk.
Return	Return of Raw Materials and Receipt of Returns of Finished Goods - All Return Defective Product steps from source – identify product condition, disposition product, request product return authorization, schedule product shipment, and return defective product – and deliver – authorized product return, schedule return receipt, receive product, and transfer defective product. - All Return Maintenance, Repair, and Overhaul product steps from source – identify product condition, disposition product, request product return authorization, schedule product shipment, and return MRO product – and deliver – authorize product return, schedule return receipt, receive product, and transfer MRO product. - All Return Excess Product steps from source – identify product condition, disposition product, request product return authorization, schedule product shipment, and return excess product – and deliver – authorize product return, schedule return receipt, receive product, and transfer excess product. - Manage Return business rules, performance, data collection, return inventory, capital assets, transportation, network configuration, regulatory requirements and compliance, and supply chain return risk.

Figure 4.4 SCOR management processes

According to SCC a process reference model contains

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

³ Supply-Chain Council, SCOR 9.0 Overview

A supply-chain configuration (figure 4.5) is driven by:

- **Plan** – that implies levels of aggregation and information sources;
- **Source** – that specifies locations and products;
- **Make** – specifying the production sites and methods;
- **Deliver** – defining channels, inventory deployment and products;
- **Return** – specifying the locations and methods.



Figure 4.5 A supply chain configuration

Each intersection of two execution processes (*Source-Make-Deliver*) is a “link” in the supply chain because execution processes transform or transport materials and/or products, and each process is a customer of the previous process and a supplier to the next.

Planning processes manage these customer-supplier links and by planning processes we can “balance” the supply chain and every link “requires” an occurrence of a plan process category.

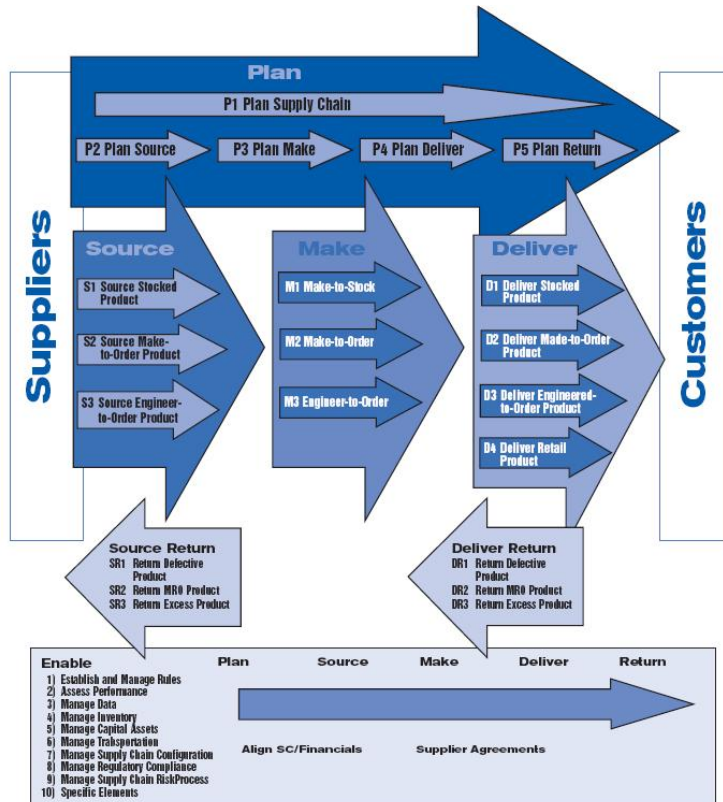


Figure 4.6 SCOR model

SCOR process types (figure 4.6) are planning, execution, and enable.

Planning – is the process of aligning the expected resources to meet expected demand requirements;

Execution – processes generally involves scheduling/sequencing, transforming product, and/or moving product to the next process, and is triggered by planned or actual demand that changes the state of material goods;

Enable - a process that prepares, maintains, or manages information or relationships on which planning and execution processes rely.

4.4.3 Oracle SCM

Oracle Supply Chain Management enables companies to predict market requirements, innovate in response to volatile market conditions and align operations across global networks. It also provides industry specific solutions based on best-in-class applications that span product development, demand management, network design, sales and operations planning, warehouse management, transportation management and supply management.

Oracle offers a complete, integrated set of solutions for the high-tech industry based on the SCOR model (figure 4.7).

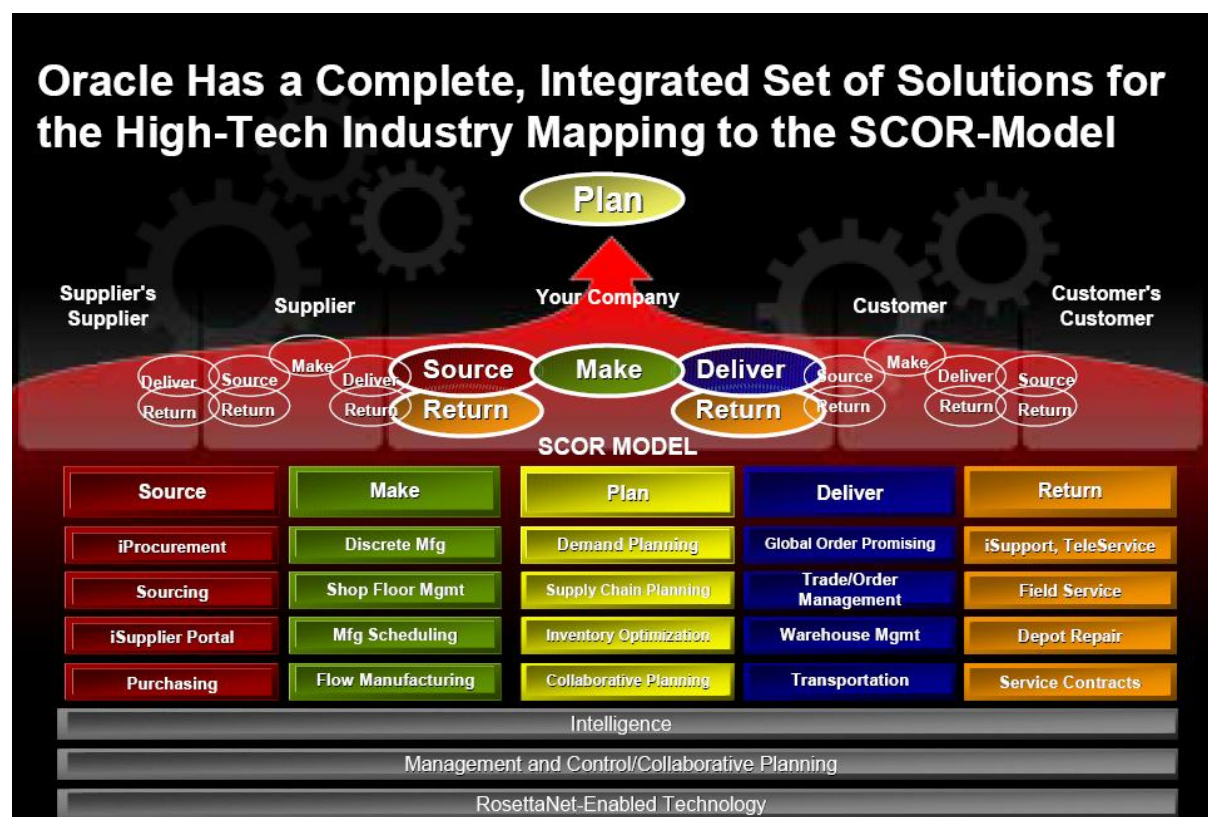


Figure 4.7 Oracle SCM based on SCOR model

The supply chain planning solution can support all types of high-tech manufacturing business models - from completely manufactured in-house operations to completely outsourced manufacturing operations. The solution provides manufacturers with real-time access to information and supports transition to the virtual manufacturing environment. Key

components of this solution include Oracle Advanced Planning, Oracle Configure to Order, and Oracle Order Management solutions.

4.4.4 SAP Supply Chain Management

SCM is the most mature component within SAP's Business Suite. SAP Supply Chain Management (SCM) transforms the supply chain into a dynamic customer-centric supply chain network and enables to plan for and streamline the firm's network of logistics and resources that come together to form a supply chain. Generally speaking, a supply chain comprises three areas—supply, manufacturing, and distribution. The supply portion of a supply chain focuses on the raw materials needed by manufacturing, which in turn converts raw materials into finished products. The distribution aspect of a supply chain focuses on moving the finished products through a network of distributors, warehouses, and outlets. Thus, SCM opens the door to cross-company collaboration as a firm gains visibility into its suppliers, vendors, and customers. SCM empowers a firm by creating a more predictable supply chain capable of capitalizing on circumstances, minimizing costs, and maximizing profitability through the following:

- Improving responsiveness via real-time insight into the entire supply chain
- Improving inventory turns by synchronizing inputs with outputs (that is, balancing supply with demand)
- Encouraging collaboration by providing visibility into trends as seen through supply chain monitoring, analysis, and business analytics

Leveraging the same SAP NetWeaver platform used by all of SAP's Business Suite components, SCM streamlines operations without taxing a firm's IT organization or SAP support team—the solution foundation and integration technologies are the same as those employed by other NetWeaver components, including WebAS, Web Services, and so on. This combination of capability and mature technology makes for a true win-win: better service, increased productivity, and improved profitability, all within the umbrella of standards-based and mature technologies. As of SCM release 4.1, SAP supports creating and maintaining an adaptive supply chain network through three components—SAP Advanced Planner and Optimizer (SAP APO), SAP Inventory Collaboration Hub (SAP ICH), and SAP Event Management (SAP EM).