

How does SCOR measure up?

A user's perspective on SCOR metrics

by Peter Bolstorff

What is SCOR?

The **Supply Chain Operations Reference** model, developed by the *Supply-Chain Council*, provides a standard methodology for managing supply chain projects centered on Plan, Source, Make, Deliver and Return.

"To keep on schedule," I told a design team at the kickoff of a SCOR project, "we've got four weeks to identify and define the number of **SCORcards** and appropriate supply chain metrics, collect data, identify sources and collect appropriate benchmark data, define competitive requirements for performance, calculate performance gaps, and determine financial opportunity." For those of you who have not been down the project roadmap, this **hit-the-ground-running** work effort represents the key tasks to produce a SCORcard gap analysis in four weeks.

As anxiety set in, the team members turned to the SCOR model documentation, which contains more than 200 alphabetically arranged definitions in the v. 5.0 metrics glossary. "Which ones do we use?" one team member asked. They remembered from previous education that SCOR suggests 13 metrics to represent Level 1 supply chain performance. A more serious question came from the company's controller, who asked, "What do we do with the rest?"

The SCOR model does a good job defining Level 1 metrics — and there are good, easy access benchmark sources for most of these — but the model does not address many shareholder metrics, and the breakdown of Level 1 metrics to their Level 2 and 3 components is not standardized. So my objective in this article is to discuss a more comprehensive SCORcard template based on my experiences working with many project teams.

The SCORcard template

The SCORcard template (see table, opposite page) summarizes the important dimensions of the supply chain performance metrics needed to build a SCORcard. The Level 1 metrics are organized by three broad categories and seven performance attributes:

- **Customer-facing** metrics measure supply chain delivery reliability, responsiveness and flexibility with respect to customers and suppliers.
- **Internal-facing** metrics measure supply chain cost and asset management efficiency.
- **Shareholder-facing** metrics measure profitability, effectiveness of return and share performance.

For each Level 1 performance metric, the template includes a working definition, benchmark sources, main Level 2 components, main Level 3 components, and a simple data

query used to calculate the actual performance. "**Not Hardwired Yet**" indicates that in over 30 projects, no standard consistent metric has surfaced to support multiple companies and industries. It does not mean that there aren't useful Level 3 metrics; I've tried to point to good sources of potential Level 3 metrics.

It is important to note that while the SCORcard gap analysis only focuses on the Level 1 metrics results, Level 2 metrics are required for many of the calculations. The remaining sections will provide lessons learned on the decomposition logic for Level 2 (material flow) and Level 3 (work and information flow).

Customer-facing metrics

Delivery performance is an example of a SCOR Level 1 metric that does not decompose to Level 2 by simple calculation. Rather it decomposes to the relative "**on time and complete delivery**" measures for suppliers, factories, warehouses and transportation providers. Level 3 decomposition is varied by the locations of Level 2 roles and the service goals of the departments in the location. **Fill rate** is another customer facing metric with a relative Level 2 decomposition; **forecast accuracy** is defined as the fill rate cascade.

The logic for many design teams is that for a stock item to be on the shelf at the time of order receipt, good planning needs to have taken place. Good planning is measured by forecast accuracy attained through a solid **sales and operations planning** process and/or leading practices like **collaborative planning, forecasting and replenishment** (CPFR).

In some projects, steering teams have elevated **forecast accuracy** to Level 1 status. In other projects, the design team defined it as a Level 2 decomposition subordinate to inventory days of supply. Level 3 decomposition is varied by the department's role in the forecast process and the goals for improvement.

Perfect order decomposes to Level 2 identical to **delivery performance** with the added component of **payable match**. From the customer's perspective, a perfect order is delivered on time and complete with a perfect item number, quantity and price match of their receipt and purchase order with your invoice. This works in a similar manner when grading suppliers on their ability to fulfill perfect orders.

Level 3 decomposition is varied by the department's role in the match process and the

THE SCORCARD TEMPLATE

	Performance Attribute or Category	Level 1 Performance Metrics	Working Definition	Benchmark Sources	Main Level 2 Components	Main Level 3 Components	Typical Query Customer
CUSTOMER FACING	Supply Chain Delivery Reliability The performance of the supply chain in delivering: the correct product, at the correct place, at the correct time, in the correct condition and packaging, in the correct quantity, with the correct documentation.	Delivery Performance	Delivery Performance measures the percentage of orders delivered "on time and in full" to customer request date and/or to customer commit date. <i>(see SCOR Glossary for definitions of all metrics)</i>	PMG On time and in full delivery to customer request and customer commit.	Supplier on time and in full delivery, Manufacturing schedule attainment, Warehouse on time and in full shipment, and Transportation provider on time delivery.	Not Hardwired Yet These are departmental and/or diagnostic measures supporting delivery performance goals.	Customer Orders Delivered On Time and In Full/Total Number of Customer Orders; use the PMG survey as a guide.
		Fill Rates	Fill Rates measures the percentage of ship from stock orders shipped within 24 hours of order receipt. Many companies use Line Item Fill Rate as an alternative metric measured by the percentage of lines filled within "committed to" hours of order receipt.	No Source Identified Most companies have their own internal gauge as to their competitive rank for line item fill rate.	Forecast Accuracy has been assigned level 2 relationship to fill rate or Inventory Days of Supply.	Not Hardwired Yet These are departmental and/or diagnostic measures supporting the forecast and planning process performance goals.	Customer Lines Delivered On Time and In Full Quantities.
		Perfect Order Fulfillment	Perfect Order Fulfillment measures the percentage of orders delivered "on time and in full" to customers request date AND flawless match of purchase order, invoice, and receipt.	No Source Identified This metric is important but difficult to get good statistical benchmark comparisons.	In addition to Delivery Performance components, Supplier Match % and Customer Match %.	Not Hardwired Yet These are departmental and/or diagnostic measures supporting perfect order fulfillment performance goals.	Customer Orders Delivered On Time and In Full with 100% match of price, item, and quantity on the invoice, packing slip, and customer PO/Total Number of Customer Orders.
	Supply Chain Responsiveness The velocity at which a supply chain provides products to the customer.	Order Fulfillment Lead Time	Order Fulfillment Lead Time measures the number of days from order receipt in customer service to the delivery receipt of at the customer's dock.	PMG Order Receipt to Order Entry, Order Entry to Order Shipment, Order Shipment to Order Receipt, and overall Order Fulfillment Lead Time.	For Stock Items Order Receipt to Order Entry, Order Entry to Order Shipment, Order Shipment to Order Receipt. For To Order Items Order Receipt to Order Entry, Order Entry to Complete Manufacturing to Order Shipment, Order Shipment to Order Receipt. Backorder Duration Another frequently used level 2 decomposition is that of Back Order Duration.	Not Hardwired Yet These are departmental and/or diagnostic measures supporting cycle time within the order fulfillment processes.	Absolute Value [Actual Delivery Date - Order Entry Date] for each line item and/or each Customer Order; use the PMG survey as a guide.
	Supply Chain Flexibility The agility of a supply chain in responding to marketplace changes to gain or maintain competitive advantage.	Supply Chain Response Time	Supply Chain Response Time measures the number of days it takes a supply chain to respond to (plan, source, make, and deliver orders) an unplanned significant increase or decrease in demand without cost penalty.	No Source Identified This metric is important but difficult to get good statistical benchmark comparisons.	Source Leadtime (often contractual), Order Fulfillment Lead Time for To Order items.	Not Hardwired Yet These are departmental and/or diagnostic measures supporting cycle time or leadtime improvement in Purchasing, Manufacturing, and Order Management.	Source Leadtime for Contrain Item + Manufacturing Cycle Time for Make-to-Order + Order Fulfillment Leadtime for Stock Items.
	Production Flexibility	Production Flexibility measures the number of days to achieve an unplanned 20% increase or decrease in orders without cost penalty.	PMG Upside Production Flexibility.	Days to Increase or Decrease Production Labor, Material, and/or Capacity.	Not Hardwired Yet None identified.	Anecdotal Query based Utilization, Staffing Model, and Supplier Contracts; use the PMG survey as a guide.	
INTERNAL FACING	Supply Chain Cost The costs associated with operating the supply chain.	Cost of Goods	Cost of Goods measures the direct cost of material and labor to produce a product or service.	PMG and www.marketguide.com See COGS under Income Statement and calculate median (middle), superior (average of top 20%), and advantage (midpoint of median and superior) based on the industry or other designated competitors.	Material Cost, Direct Cost of production, and Indirect Cost of Production.	Not Hardwired Yet These are departmental and/or diagnostic measures supporting unit cost goals.	Cost Centers for Material + Cost Centers for Direct Manufacturing Labor + Cost Centers for Indirect Manufacturing Labor.
		Total Supply Chain Management Cost	Total Supply Chain Management Cost measures the direct and indirect costs to plan, source and deliver products and services. Make costs are often captured in COGS while Return costs are calculated in Warranty>Returns Processing Costs.	PMG Order Management Cost, Material Acquisition Cost, SC Related IT Cost, Inventory Carrying Cost, Finance and Planning Related Cost.	Order Management Cost, Material Acquisition Cost, Finance and Planning Related Costs, MIS Costs, and Inventory Carrying Costs.	Customer Service Cost, Outbound Transportation Cost, FG Warehouse Cost, Purchasing Cost, Inbound Transportation Cost, RM Warehouse Cost, Demand Planning, and Supply Planning. Transactional Productivity is an alternative level 3 measure: i.e., divide Material Acquisition Costs (people hours) divided by Purchase Orders.	Map the cost centers that support the supply chain activities listed at Level 3, then add them up; use the PMG survey as a guide.
		Value Added Productivity	Value Added Productivity is calculated by subtracting direct material cost from the revenue and dividing the result by the number of employees. This is similar to sales per employee.	No Source Identified This metric provides an overall comparison but is difficult to manage supply chain performance.	Revenue, Direct Material Cost, Number of Employees in FTEs.	Not Hardwired Yet Use Level 2 metrics as source for Level 3 components.	[Revenue \$ - Direct Material Cost \$] / Total Number of Employee in FTEs.
		Warranty>Returns Processing Cost	Warranty>Returns Processing Cost measures the direct and indirect costs associated with returns including defective, planned maintenance, and excess inventory. This includes the entire reverse logistics process.	No Source Identified This metric is important but difficult to get good statistical benchmark comparisons.	Returns Warehouse Cost, Returns Authorization Processing Cost, Return Maintenance Cost, Returns Transportation Cost (inbound from customer, intercompany, and outbound to supplier).	Not Hardwired Yet These are departmental and/or diagnostic measures supporting warranty and return cost goals.	Map the cost centers that support the supply chain activities listed at Level 2, then add them up.
	Supply Chain Asset Management Efficiency 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	Cash-to-Cash Cycle Time measures the number of days that cash is tied up as working capital.	PMG and www.marketguide.com Days Payables Outstanding, Days Sales (Receivables) Outstanding.	Days Payables Outstanding, Days of Inventory, and Days Sales (Receivables) Outstanding.	\$ Payables, Cost of Materials, Accounts Payables Terms, Inventory \$, Cost of Goods, \$ Receivables, Revenue, Accounts Receivables Terms.	[\$ Inventory / (COGS / 365)] + [\$ Receivables / (Revenue / 365)] - [\$ Payables / (Material Cost / 365)] Use PMG Survey as a guide
	Inventory Days of Supply	Inventory Days of Supply measures the number of days that cash is tied up as inventory.	PMG and www.marketguide.com Days RM Inventory, Days WIP Inventory, and Days FG Inventory; for marketguide, calculate median (middle), superior (average of top 20%), and advantage (midpoint of median and superior) based on the industry or other designated competitors.	Days RM Inventory, Days WIP Inventory, and Days FG Inventory.	Within each level 2 inventory type, inventory classifications differ by organization but often are based on volume and/or turns; classification language often is noted by A items, B items, C items, and D items as well as non-working inventory.	\$ Inventory by classification/ (COGS by classification/365)	
	Asset Turns	Asset Turns is calculated by dividing revenue by total assets including both working capital and fixed assets.	PMG and www.marketguide.com Revenue, Total Net Assets; for marketguide, calculate median (middle), superior (average of top 20%), and advantage (midpoint of median and superior) based on the industry or other designated competitors.	Revenue, Working Capital, and Fixed Assets.	Use Level 2 metrics as source for Level 3 components.	Revenue \$/Total Net Asset \$	
SHAREHOLDER FACING	Profitability Income after cost.	Gross Margin	Gross Margin is calculated by subtracting Cost of Goods from Revenue and is most often expressed as a % of the remaining dollars to sales.	www.marketguide.com Revenue, Cost of Goods; for marketguide, calculate median (middle), superior (average of top 20%), and advantage (midpoint of median and superior) based on the industry or other designated competitors.	Revenue, Cost of Goods.	Use Level 2 metrics as source for Level 3 components.	* SCOR Level 1 Metric: Definition of SCOR Level 1 Metrics found in the Glossary of the model document.
		Operating Income	Operating Income (or Margin) is calculated by subtracting Cost of Goods AND Sales, General and Administration (SG&A) from Revenue and is most often expressed as a % of the remaining dollars to sales.	PMG and www.marketguide.com Revenue, Cost of Goods, and SG&A; for marketguide, calculate median (middle), superior (average of top 20%), and advantage (midpoint of median and superior) based on the industry or other designated competitors.	Revenue, Cost of Goods, SG&A.	Use Level 2 metrics as source for Level 3 components.	(Revenue \$ - Cost of Goods \$) / Revenue \$
		Net Operating Income	Net Operating Income (or Margin) is calculated by subtracting Cost of Goods AND Sales, General and Administration (SG&A) AND Taxes from Revenue and is most often expressed as a % of the remaining dollars to sales.	www.marketguide.com Revenue, Cost of Goods, SG&A, Taxes, AND Interest Expense; for marketguide, calculate median (middle), superior (average of top 20%), and advantage (midpoint of median and superior) based on the industry or other designated competitors.	Revenue, Cost of Goods, SG&A, and Corporate Taxes.	Use Level 2 metrics as source for Level 3 components.	(Revenue \$ - Cost of Goods \$ - SG&A Costs) / Revenue \$
		Economic Profit	Operating Income (or Margin) is calculated by subtracting Cost of Goods AND Sales, General and Administration (SG&A) AND Taxes AND Cost of Capital from Revenue and is most often expressed as a % of the remaining dollars to sales.	www.marketguide.com Revenue, Cost of Goods, SG&A, and Taxes; for marketguide, calculate median (middle), superior (average of top 20%), and advantage (midpoint of median and superior) based on the industry or other designated competitors.	Revenue, Cost of Goods, SG&A, Corporate Taxes, and Interest Expense.	Interest Expense is partially calculated by cost of money and working capital.	(Revenue \$ - Cost of Goods \$ - SG&A Costs - Tax \$) / Revenue \$
	Effectiveness of Return	Return on Assets	Return on Assets is calculated by dividing Net Operating Income by Total Net Assets	www.marketguide.com Net Operating Income, Total Net Assets.	Revenue, Cost of Goods, SG&A, Corporate Taxes, Interest Expense, and Total Net Assets.	Use Level 2 metrics as source for Level 3 components.	(Revenue \$ - Cost of Goods \$ - SG&A Costs - Tax \$ - [Working Capital \$ + Cost of Money]) / Revenue \$
		Return on Sales	Return on Sales is calculated by dividing Net Operating Income by Total Revenue.	www.marketguide.com Net Operating Income, Total Revenue.	Revenue, Cost of Goods, SG&A, Corporate Taxes, Interest Expense, and Total Revenue.	Use Level 2 metrics as source for Level 3 components.	Net Operating Income \$ / Total Net Asset \$
		Return on Investment	Return on Investment (or invested capital) is calculated by dividing Net Operating Income by Total Invested Capital.	www.marketguide.com Net Operating Income, Total Invested Capital.	Revenue, Cost of Goods, SG&A, Corporate Taxes, Interest Expense, and Total Invested Capital.	Use Level 2 metrics as source for Level 3 components.	Net Operating Income \$ / Total Revenue \$
	Share	Earnings Per Share	Earning Per Share is the adjusted income available to Common divided by the diluted weighted average shares outstanding.	www.marketguide.com Adjusted income, Diluted weighted average shares outstanding.	Not Hardwired Yet None Identified.	Not Hardwired Yet None Identified.	Use company formula.
EPS Percent Change TTM		This is the percent change in the trailing twelve month (TTM) EPS as compared to the same TTM period one year ago.	www.marketguide.com	Not Hardwired Yet None Identified.	Not Hardwired Yet None Identified.	Use company formula.	
Stock Price Percent Change TTM		This is the percent change in the trailing twelve month (TTM) Stock Price as compared to the same TTM period one year ago.	www.marketguide.com	Not Hardwired Yet None Identified.	Not Hardwired Yet None Identified.	Use company formula.	

goals for improvement. **Order fulfillment lead time** decomposes to Level 2 by calculation. It calculates for each order, the number of days to deliver on time and complete. *Performance Measurement Group (PMG)* (www.pmgbenchmarking.com) breaks it into [three basic process steps](#)

and by item type (e.g. stock versus to-order).

Another frequently used Level 2 decomposition is **back order duration**. A subset of all orders, it calculates the number of days it takes missed or partially delivered orders to deliver complete. Level 3 decomposition is

varied by the department's role in the order fulfillment process and the goals for improvement.

Supply chain response time decomposes to Level 2 by calculation. It calculates the number of days by adding plan (or re-plan) days to contracted source lead time, manufacturing cycle

time and **order fulfillment lead time of stocked items**. Level 3 decomposition is varied by the department's role in the managing lead time or cycle time processes and the goals for improvement.

Production flexibility decomposes to Level 2 by a mix of estimation and calculation. For material, labor and capacity, determine the number of days it would take to sustain unplanned requirements of plus/minus 20%. Estimate the principal constraint. No Level 3 metrics are identified.

Internal-facing metrics

Internal measures are more deliberate in the decomposition because as they involve [costs](#) and [inventory numbers](#), they have to add up.

Cost of goods sold decomposes to **material cost, direct cost of production, and indirect cost of production** at Level 2. Level 3 is **Not Hardwired Yet** as these are departmental and/or diagnostic measures supporting unit cost goals.

Supply chain management cost decomposes to **order management cost, material acquisition cost, finance and planning related, supply chain related management information system (MIS) cost, and inventory carrying cost**. Level 2 metrics decompose to Level 3 measures for **customer service cost, outbound transportation cost, finished goods (FG) warehouse cost, purchasing cost, inbound transportation cost, raw material (RM) warehouse cost, demand planning, and supply planning cost, MIS fixed assets, and MIS operational costs**.

Inventory carrying cost is the only hitch. This is not a pure operational cost; it combines costs for taxes, insurance and write-offs for non-working inventory. It then borrows from other metrics like cost of capital for inventory and space costs from **order management**.

Transactional productivity is an alternative Level 3 way to measure some aspects of supply chain cost. **Purchase order productivity** divides **material acquisition cost** (or people hours) by the **number of purchase orders**; **sales order productivity** divides **order management cost** (people hours) by the **number of sales orders**. **Work orders, return authorizations** and **planning events** are other transactions that can be calculated in a similar manner.

Value-added productivity decomposes at Level 2 to **revenue, direct material cost, number of employees in full-time equivalent (FTE) jobs**. Level 3 is **Not Hardwired**

Yet; many design teams use the calculations for Level 2 metrics as the source for Level 3 components.

Warranty/returns processing cost decomposes to **returns warehouse cost, returns authorization processing cost, returns maintenance cost, returns transportation cost** (inbound from customer, intercompany, and outbound to supplier). Level 3 is **Not Hardwired Yet**.

Cash-to-cash decomposes to Level 2 components of **days payables outstanding, days of inventory and days sales (receivables) outstanding**.

Level 3 elements include the data elements of **\$ payables, cost of materials, accounts payables terms, inventory \$, cost of goods, \$ receivables, revenue, and accounts receivables terms. Inventory days of supply** decomposes to Level 2 metrics of **days RM inventory, days of work-in-process (WIP) inventory, and days of FG inventory**. Level 3 inventory classifications differ by organization but often are based on volume and/or turns; classification language often is noted by A items, B items, C items and D items as well as non-working inventory.

Asset turns decomposes to Level 2 elements of **revenue, working capital and fixed assets**. The Level 3 components for **working capital** follow the same decomposition path as cash-to-cash.

Shareholder-facing metrics

Gross margin decomposes to Level 2 components of **revenue and cost of goods**. Use **cost of goods** as the source for Level 3 components.

Operating income or margin decomposes to **revenue, cost of goods, sales, general & administrative (SG&A) expense**. Use **cost of goods** and **SG&A** expense categories as metrics for Level 3 components.

Net operating income or margin decomposes to **revenue, cost of goods, SG&A and corporate taxes**. Use **cost of goods, SG&A and corporate tax rate expense** categories as a metrics for Level 3 components.

Economic profit decomposes to **revenue, cost of goods, SG&A, corporate taxes and interest expense**. In addition to the expense categories in **net operating income**, Level 3 decomposition also includes **interest expense** calculated, in part, by cost of money and working capital.

Return on assets decomposes to **net operating income and total net assets**; in some cases companies prefer to use **operating income** instead. Level 3 decomposition is based on the **net operating income and total net assets** decompositions discussed previously.

Return on sales decomposes to **revenue and net operating income**.

Level 3 decomposition is based on the **net operating income** decompositions discussed previously.

Return on investment decomposes to **net operating income and total invested capital**. Level 3 decomposition is based on the **net operating income** decompositions discussed previously. Share data is calculated and defined at Level 1; there has been no need to decompose any further in a SCOR project.

How many SCORcards?

A critical task of the business is to determine how many SCORcards need to be assembled. Ideally, there is a SCORcard for each supply chain identified in the project scope and an enterprise consolidated SCORcard (see "Scale the Heights" in the Dec. 2001 SCTN for supply chain definition techniques).

The level of difficulty of completing this task is mostly dependent on accounting practices for the internal-facing and shareholder-facing metrics. The most complicated case occurs in companies that define supply chains by customer channel yet consolidate financial reporting by product group or location.

In this case, the design team might decide to combine onto one SCORcard the customer-facing data for each supply chain and with the consolidated internal-facing and shareholder-facing data; it is wise to **match the costs with the revenue and inventory**. Almost always, companies change their reporting capability to be able to SCORcard each supply chain independently.

This template is *not* perfect. It is *not* intended to become a standard; rather, it is intended to share lessons learned since it has been used.

The more user discussions we initiate on the trials and tribulations of using the SCOR metrics, the closer we will get to establishing standard ways of measuring performance. In addition, the more benchmark sources we can establish at Level 1 and Level 2, the more effectively we can compare and contrast companies and industries.

By the way, the design team mentioned earlier completed its gap analysis on time and on budget. It provided the basic framework for supply chain **key performance indicators** (KPIs) and cascading organizational performance goals. ◀

keeping SCOR

Updating the Supply-Chain Council's implementation model

acronyms solved

COGS	cost of goods sold
CPFR	collaborative planning, forecasting and replenishment
FG	finished goods
FTE	full-time equivalent
KPI	key performance indicator
MIS	management information system
RM	raw material
SG&A	sales, general & administrative

About SCOR

The Supply Chain Operations Reference (SCOR) model has been developed by the Supply-Chain Council and is **SCTN**'s recommended implementation model for SCM initiatives. While the author of this article is affiliated with the Supply-Chain Council, this article was prepared under the direction of **SCTN** and was not subject to prior review or approval by the Supply-Chain Council or any of its members/affiliates.

To learn more about the Supply-Chain Council, including a white paper guide to Level 1 metrics: www.supply-chain.org



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