
# Enhancing supply chain performance measurement frameworks with external global indicators

By Tan Miller


Adopting a hierarchical supply chain performance measurement framework allows a firm to organize its performance metrics and align them with its supply chain management structure.

Performance metrics play a critical role in the planning and management of a firm's supply chain operations and network. Today, firms employ an ever-increasing array of dashboards, scorecards, and key performance indicators (KPIs), all of which provide perspective on both the efficiency and effectiveness of a firm's internal operations and its external interactions with customers and suppliers.

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At the same time, and with far less publicity and general industry awareness, a second type of supply chain status measures have emerged and flourished. We will term these "macro indicators" that offer a perspective not at the "individual firm" level, but rather at much broader macro levels such as international transportation lanes (e.g., China to the United States), geographic regions (e.g., the United States, Germany, and Asia), and other groupings. These macro indicators vary widely, appear in many different forms, and utilize different methodologies. However, they share the common characteristic of offering an evaluation of some aspect of supply chain operations that will generally affect many firms across many industries. Finally, we note that many of these measures have existed for decades in relative obscurity, while others represent more recently created tools developed in response to the supply chain disruptions associated with the recent pandemic.

In this article, we will first discuss individual firm supply chain performance metrics, and then consider supply chain macro indicators. Our discussion of firm-level metrics presents a general framework that a supply chain organization can employ to house its performance measures. The macro indicator discussion that follows afterward highlights both the global as well as the narrower perspectives these measures can offer about particular supply chain activities, transportation modes and geographic regions. Finally, we will present and illustrate approaches supply chain professionals and their firms can utilize to integrate these two disparate forms of metrics.

## A supply chain performance measurement framework for an individual firm

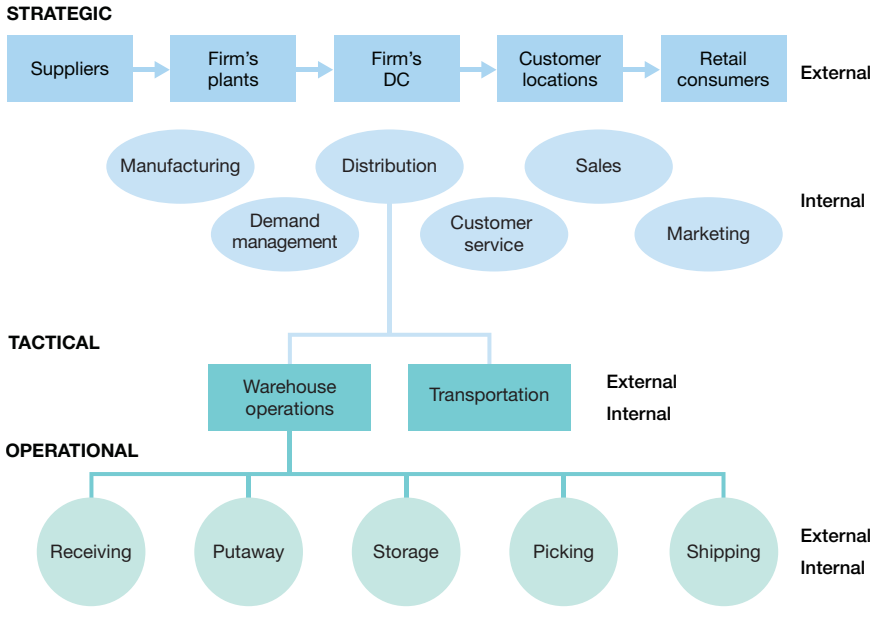
The development and availability of insightful metrics represents an absolute prerequisite for a firm when managing its supply chain operations. *However, how a firm organizes its metrics and how these metrics align with the firm's supply chain management decision framework represents an equally important issue that is often overlooked.* Therefore, in this section, we present a hierarchical supply chain performance measurement framework that a firm can employ to organize its performance metrics and align them with its supply chain management structure.

For clarity, before reviewing this framework, we distinguish the difference between measures, metrics, and indexes; which are all used for performance measurement and predictive purposes. A measure requires no calculations and has simple dimensions. Some examples include units of inventory and backorder dollars. A metric requires a calculation or a combination of measures, often in the form of a ratio. Examples include inventory future days of supply, inventory turns, and sales dollars per stock keeping unit (SKU). An index combines two or more metrics into a single indicator, usually used to track trends in the outputs of a process. Two examples are a perfect order fulfillment index and a facility utilization index for a network of plants. A performance management system typically is comprised of a set of measures, metrics, and indexes. Because metrics and indexes utilize measures, for simplicity, we will use the term measure when either a measure, metric or index might be appropriate.

Supply chain performance management is needed for monitoring and control at three levels: the strategic, tactical, and operational. Generally, these three levels are differentiated by their time horizon: the long run, intermediate term, and short run, respectively. However, in the hierarchical supply chain performance (HSCP) framework presented here, the scale or relative magnitude of an operation or activity that a performance measure monitors determines where it fits in the hierarchy. Within each of the three levels of the HSCP framework, we further differentiate performance measures as either external or internal. *External measures* focus upon the effectiveness of a firm's shipments or flows across its network and to customers, while *internal measures* evaluate a firm's efficiency in producing or delivering its outputs and services. Typical external performance metrics are order and line-item fill rates on customer orders. For example, when a mass merchandiser places an order to a product supplier, these metrics track whether the supplier delivers the total order and the individual items on time and complete as ordered. However, these external metrics do not evaluate the supplier's order delivery cost, such as whether the order was delivered on time but by expensive air freight rather than originally planned surface transportation because of a production delay. In this example, while the order delivery was effective (i.e., it met the customer's time requirement), it was not efficient (i.e., it was more costly than a normal surface delivery). Internal performance metrics such as "distribution cost per case"

FIGURE 1

**A hierarchical supply chain performance measurement framework for an individual firm**




Source: Author

and "freight cost per pound" would be adversely affected by using the more expensive air delivery mode, if surface delivery is the normal mode planned for a lane.

Figure 1 displays the HSCP framework, showing the three levels (strategic, tactical, operational), and the two measurement perspectives (external and internal). At the strategic level from an external perspective, this framework spans the firm's facilities network, through plants, distribution centers, customers, and consumers. From the internal perspective at the strategic level, we include the firm's top-level functions related to supply chain, such as distribution. At the tactical level, performance measures are required for such activities as warehouse operations and transportation, since these are the key functions of distribution. Drilling down into warehouse operations, we see in Figure 1 that it has five major sub-functions or processes at the operational level: receiving, putaway, storage, picking, and shipping. Internal and external performance measures are required at each level in this framework. (A similar three-level framework would be used for each major supply chain function of the firm.)

## Applying the hierarchical performance framework to specific logistics functions

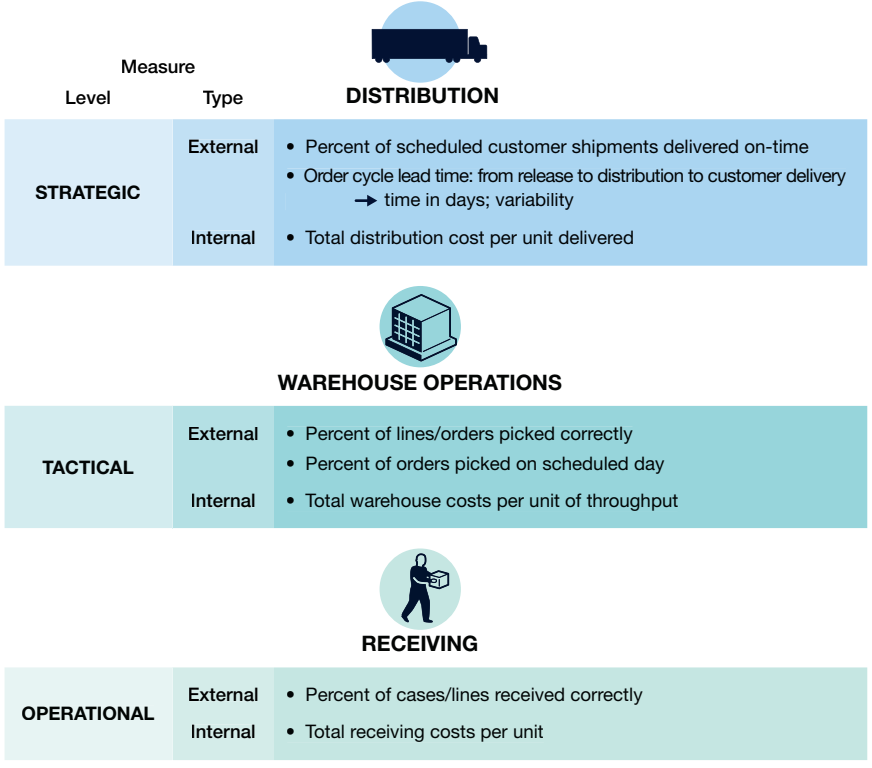
Figure 2 indicates how internal and external performance measures are set across the three levels of the HSCP framework, continuing with distribution as our example. For the distribution organization (strategic level), percent of scheduled customer shipments delivered on-time, and the average and variance of order cycle lead time represent external metrics, since they help to measure flows across the supply chain. They are strategic because they address the mission of the distribution function, ensuring delivery of products and services to customers in a timely manner. The total distribution cost per unit delivered is an internal, strategic metric since it measures the efficiency of distribution at the highest organization level.

At the tactical level, the percent of lines or orders picked correctly, and the percent of orders picked on the scheduled day, represent external metrics because they evaluate the impact of warehouse operations across the supply chain. When a warehouse picks an order correctly, it contributes to the successful delivery of products to a customer who has placed an order. Similarly, when

a warehouse picks an order on the scheduled day, this contributes toward a successful on-time delivery of products to a customer. The third tactical metric shown in Figure 2, total warehouse costs per unit of throughput, represents an internal metric since it offers a summary view of the internal cost (and efficiency) of the warehouse operation.

FIGURE 2

**Illustrative hierarchical performance measures for distribution function of an individual firm**




Source: Author

Focusing on the warehouse receiving function at the operational level, the percentage of cases (or lines) received correctly (i.e., accurately) is an example of an external performance metric. We categorize this metric as external because the accuracy with which this function receives inbound shipments will affect the next stage of the distribution flow. For example, suppose that the receiving area miscodes an inbound receipt as product A, when in fact it received a delivery of product B. If this error remains undetected, this inventory of product B will then be put away into inventory classified as product A. Then, at some future point, this product could be picked and delivered to a customer who ordered product A, thereby creating a customer service issue, since the product delivered would really be product B (and not A as ordered). Therefore, the percentage of lines or cases received correctly is classified as an external measure. In contrast, total receiving cost per unit has an internal orientation and will be of most immediate concern to receiving and warehouse personnel.

The HSCP framework offers several important benefits. First, it provides a unified framework for aggregating performance measures across an organization. It enables a firm to organize its key performance measurements into a structure that leads to a relatively few, high-level, strategic measures (e.g., between 10 and 25) that monitor overall firm performance. These are sometimes referred to as KPIs or key performance indicators. Second, this structure facilitates having additional performance measures that monitor smaller components of a firm's operation that align with overall firm objectives. In this way all functional areas can develop and maintain their own measures and contribute to an overall measurement system. In addition, each function can focus on a few key measures to help improve its performance. Finally, the HSCP framework contributes toward aligning the collective activities of a firm to meet a desired mission and set of objectives. For example, if a firm has a comprehensive measurement system in place that covers its major functional areas, managers can view the system in its entirety to identify any potential misaligned activities or objectives.

## "Macro" supply chain performance measures and indicators

Perhaps the best way to introduce what we categorize as supply chain macro performance measures is to consider the large, but by no means comprehensive, listing of these indicators displayed in Table 1. (See pages 46-48) We encourage the reader to review this table closely, paying particular attention to the column titled "description of the supply chain component monitored" of each indicator.

A careful read of Table 1 reveals that there exist sophisticated monitoring tools that cover virtually every geography, transportation mode, and other supply chain activity (e.g., warehousing) that may affect an individual firm's operations. To provide perspective on the myriad indicators displayed in Table 1, one can group these tools into the following general categories.

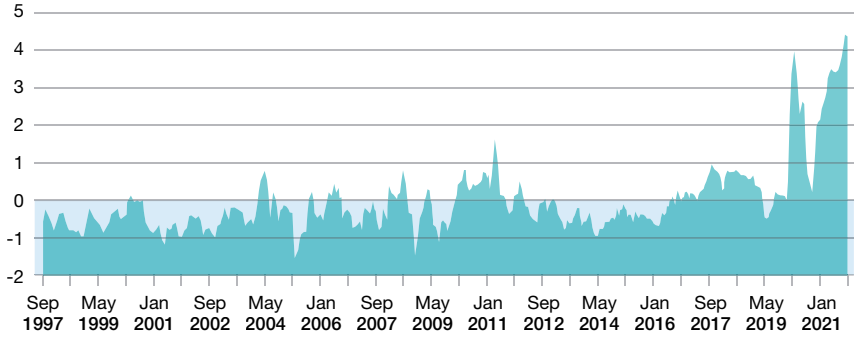
1. Rail transportation
2. Truckload transportation
3. Ocean transportation
4. Air freight transportation
5. Supplier delivery speed and performance
6. Manufacturer delivery speed and performance
7. Warehousing activity level and capacity
8. Overall supply chain performance and pressure

Within each category one observes multiple types of measures/indicators and computational methodologies ranging from simple counts to sophisticated analytic techniques. For example, the Association of American Railroads (AAR) provides weekly counts of total rail carload shipments per week and comparisons of these counts to one year prior. These and the other metrics published by the AAR offer a good perspective on the demand trends in rail freight usage and capacity. Firms such as Cass and Truckstop.com maintain indexes that furnish insights on both the demand and the capacity utilization rates in the North American trucking market. Several providers such as the Baltic Exchange, Drewry, Freightos, Flexport and Kiehl publish indexes and other metrics offering insights on both ocean and air freight prices, delivery times, capacity utilization and related measures. The U.S. regional federal reserve banks and organizations such as the Institute for Supply Management

FIGURE 3

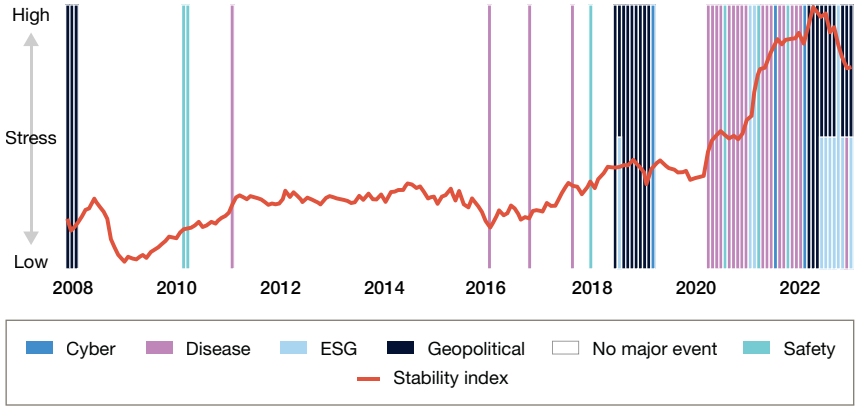
### New York Federal Reserve Bank's global supply chain pressure index, and KPMG's supply chain stability index

**New York Federal Reserve Bank's global supply chain pressure index**
(Standard deviations from average value)




Source: Gianluca Benigno, Julian di Giovanni, Jan J. J. Groen, and Adam I. Noble, "A New Barometer of Global Supply Chain Pressures" Federal Reserve Bank of New York Liberty Street Economics, January 4, 2022.

**KPMG's supply chain stability index**




Source: ASCM/KPMG

(ISM) and IHS Markit publish data on supplier and manufacturer delivery speeds, capacity utilization levels, and activity level trends. The Logistics Manager's Index, developed by a consortium of academics and CSCMP (Council of Supply Chain Management Professionals) offers similar evaluations of the activity levels, capacity, and related data on U.S. warehousing.

While the aforementioned measures focus on specific areas of supply chain operations (e.g., ocean freight), another group of general measures of overall supply chain performance also exist. *The Bloomberg Trade Tracker*, the New York Federal Reserve Bank's *Global Supply Chain Pressure Index*, and *KPMG's Supply Chain Stability Index* (developed in conjunction with the Association for Supply Chain Management (ASCM)) represent three such examples. These indicators employ various advanced statistical, econometric, and other analytic methods to generate an overall performance and stress level assessment of all supply chain activities judged collectively. Both the N.Y. Federal Reserve Bank and KPMG focus on the U.S. supply chain, while Bloomberg tracks the global economy. The N.Y. Federal Reserve Bank and KPMG employ advanced analytic methods to create an overall single index, while Bloomberg statistically evaluates how many of its 10 key indicators are *below normal, normal, and above normal*, respectively. Figure 3 displays a snapshot of the Global Supply Chain Pressure and the Supply Chain Stability indexes.

Table 1's diverse set of measures raise the following questions for an individual firm's supply chain professionals.

1. How can we select a smaller subset of these available tools that will best support and enhance our planning process?
2. How can we incorporate these macro indicators into our supply chain planning and performance monitoring process?

To illustrate how an individual firm can address these questions and incorporate macro supply chain performance indicators into its planning process, we have tapped into more than 20 years of experience in private industry as well as ongoing dialogues with supply chain colleagues currently in industry to develop the following scenario for a fictitious consumer product goods (CPG) company.

## CPG Company XYZ Inc.

XYZ Inc. manufactures and distributes consumer products globally. It has manufacturing facilities in Asia, Europe, and the United States, and it sells its products in more than 100 countries. XYZ ships consumer goods to its global customer base from a mix of company-owned and third-party distribution centers located across all its major markets. The U.S. supply chain organization of XYZ has a well-established performance measurement system which it employs to monitor the performance levels of all its internal operations, as well as its external customer and supplier facing activities. Since the onset of the pandemic in early 2020, XYZ's U.S. supply chain, like those of many other firms, has experienced disruptions and much higher levels of volatility than pre-pandemic years. This volatility has primarily resulted from macro supply chain factors beyond XYZ's control such as dramatic fluctuations in ocean freight prices and available capacity on shipments from Asia to the U.S. This has prompted XYZ's supply chain leadership to explore options for enhancing its current performance measurement system (PMS) so that it can better anticipate the impact of these external macro factors on XYZ's operations.

## How XYZ's U.S. supply chain group enhanced its PMS and planning process with external macro indicators

To incorporate external macro indicators into its PMS and supply chain planning process, XYZ first studied the key macro factors that had significantly affected its operations in recent years. XYZ's evaluation yielded the following macro factors list.

1. ***Warehousing labor availability and costs.***
   - XYZ's mix of company-owned and third-party U.S. warehouses had experienced major costs increases and intermittent staffing shortages in recent years.

2. ***Ocean container freight costs, availability, and transit times.***
   - XYZ ships finished goods from its plants in Asia to

its U.S. DCs for distribution to U.S. customers. Ocean container freight rates have dramatically risen and then fallen in the last several years.

3. ***Supplier lead times.***
   • XYZ purchases raw materials and components from suppliers for its U.S. plants. Additionally, it purchases some finished goods from suppliers, and then XYZ sells these products to its U.S. customers along with XYZ's internally manufactured products. Supplier lead times have fluctuated wildly in recent years.

4. ***Air freight transit times and costs.***
   • XYZ uses air freight as a backup option when U.S. inventories of finished goods produced in Asia drop below critical levels. Air freight transit times and costs have also fluctuated greatly in recent years.

With the key macro factors that affect its operations identified, XYZ then conducted a search to determine the available supply chain indicators that would provide insights and trends regarding these factors. XYZ's search generated a list of sources and indicators similar to those displayed in Table 1. XYZ's next step consisted of selecting a set of indicators from its search results to integrate into its PMS planning system and process.

## XYZ's macro supply chain status indicators

XYZ's U.S. Supply Chain organization selected the following indicators from its larger initial list, i.e., its version of Table 1. (This list is illustrative and not meant to suggest that the author recommends these indicators as a preferred set.)

1. ***The Logistics Managers Index***—to monitor warehouse labor availability and costs.

2. ***The Baltic Dry Index, the Drewry World Container Index, and the Flexport Ocean Timeliness Indicator***—to track ocean container freight costs, availability, and lead times.

3. ***The U.S. ISM Supplier Deliveries Index***—to monitor supplier lead times.

4. ***The Flexport Air Timeliness Indicator***—to track air freight lead times and costs.

5. ***The Bloomberg Trade Tracker, the New York Federal Reserve Bank Global Supply Chain Pressure Index, and the KPMG Supply Chain Stability Index***—to monitor the status of the global and U.S. supply chains.

## How XYZ (or any firm) can utilize these macro indicators

There is no well-established, rigorous methodology by which macro indicators can be seamlessly integrated into a firm's existing supply chain performance measurement system. With that caveat, the following represent several suggested approaches that XYZ, or any firm, can employ.

1. ***Informally update and review indicators at a standard, fixed interval (e.g., once a month or once a quarter).*** This represents the simplest approach. There is no attempt made to explicitly utilize these indicators. Rather, the firm's supply chain professionals keep abreast of current broad-based macro trends that may affect their individual supply chain either in the near or medium term. In the busy corporate world, managers understandably focus primarily upon their firm's own supply chain. However, there is managerial value in also maintaining the broader perspective yielded by a regular review and evaluation of key macro status indicators.

2. ***Formally track and report on macro indicators just as a firm tracks and internally publishes existing metrics such as line item fill rate every month.*** This prompts the question: What is the difference between approach 1 (a regular, informal review) and this second approach? First, formally maintaining this data facilitates easy reference and review. Secondly, while it may seem trivial, the process of regularly updating these macro indicators in a firm's internal database stimulates greater firm awareness of potential future issues. Further, this author's personal experience is that the monitoring and formal reporting of this type of data stimulates a supply chain organization to explore innovative ways to utilize this information, and over

TABLE 1

## Selected supply chain macro indicators and their sources firm

| | Provider or source of measure or indicator | Geography covered | Transportation modes covered | Description of the supply chain component monitored | Type of measure or indicator |
|---|---|---|---|---|---|
| 1 | Association of American Railroads Weekly Carload Report | North America | Railroads | Provides weekly count of all rail carload shipments in North America and shows comparisons to weekly shipments one year prior. Also provides data by major commodity category such as chemicals, coal, etc. | Count |
| 2 | Baltic Dry Index | Global - 23 different shipping routes | Dry bulk ocean shipping | Provides a benchmark for the price of moving the major raw materials by sea. | Composite of sub-indexes |
| 3 | Bloomberg Trade Tracker | Global - focus on shipping routes | Primarily ocean | 10 primary gauges, four price indicators provide insights on strength of global trade. | Multiple indexes |
| 4 | Cass Freight Shipment Index | North America - truckload, LTL freight | Trucking | Measures intra-continental truck freight shipments across North America for everything from raw materials to finished goods. | Index |
| 5 | Cass Truckload Linehaul Index | United States | Trucking | Indicator of market fluctuations in per-mile dry van truckload pricing in the U.S. | Index |
| 6 | Drewry World Container Indexes | Major east west container shipping trade routes | Ocean container shipping | Monitors spot container rates on 8 major shipping routes. | Composite index |
| 7 | Flexport Ocean Timeliness Indicator[A] | Trans-Pacific eastbound (Asia to North America) and Far East westbound (Asia to Europe) | Ocean container shipping | Measures time taken to ship freight from when cargo is ready to leave the exporter (cargo ready date) to when it is collected from its destination port (destination departure date). | Two indicators |
| 8 | Flexport Air Timeliness Indicator | Asia to North America and Asia to Europe | Air freight | Measures time taken to move airfreight from its point of consolidation to arrival at its final destination. | Two indicators |
| 9 | Freightos Baltic Index[B] | Global - container shipping routes | Ocean container shipping | Is an international daily freight rate index providing market rates for 40 foot containers (FEUs). | Index |
| 10 | Freightwaves | Global and US | Multiple modes including truckload | Is a price reporting agency focused on the global freight market and provides price, demand, and capacity data. | Index (on US linehaul truckloads) and numerous other measures |
| 11 | GEP Global Supply Chain Volatility Index | Global - and available by regions of Europe, Asia and North America | NA[D] | Is derived from S&P Global's PMI™ surveys, sent to firms in over 40 countries, totaling about 27,000 companies. Measures capacity and volatility at a macro level. | Index based on PMI and S&P data. Multiple measures/ indexes available |
| 12 | Global Supply Chain Pressure Index (GSCPI) – Liberty Street Economics, NY Federal Reserve Bank | Global | NA[D] | Measures supply chain disruptions and volatility by using data on ocean shipping costs and air freight costs for freight flights between Asia, Europe and the US, as well as supply chain-related components of the Purchasing Managers Index (PMI) surveys such as delivery times, backlogs and purchased stocks. | Index based on numerous other indexes and econometric analysis. Analyzes conditions back through 1997 to provide historical perspective. |
| 13 | Harpex (HARPER PETERSEN Charter Rates) | Global | Ocean container shipping | Measures worldwide prices on the charter market for container ships. | Index |
| 14 | IHS Markit Suppliers' Delivery Times Index | Global - 44 countries | NA[D] | Captures the extent of supply chain delays in an economy, which in turn acts as a useful barometer of capacity constraints. | Index |

[A] Flexport also had a US Logistics Pressure Matrix that is no longer being updated.

[B] Is operated in cooperation with the Baltic Exchange. Note also that Freightos indicates they plan to offer an air freight index in the near future.

[C] Also measures effective capacity utilization rates of container ships.

[D] NA indicates a measure or indicator that addresses general supply chain activities (e.g., warehousing activities) that are not limited to just transportation.

[E] There are ISM Reports for many other geographies besides the United States which provide similar information on these geographies.

Source: Author

TABLE 1 Continued...

## Selected supply chain macro indicators and their sources firm

| | Provider or source of measure or indicator | Geography covered | Transportation modes covered | Description of the supply chain component monitored | Type of measure or indicator |
|---|---|---|---|---|---|
| 15 | ISM Reports | United States[E] | NA[D] | Provide indication of trends in manufacturing and services industries. | Indexes |
| 16 | US ISM Supplier Deliveries Index | United States | NA[D] | Measures increase or decrease in the speed of supplier deliveries. | Index |
| 17 | Kiel Trade Indicator[C] | Global - 75 countries | Ocean container shipping | Estimates the global trade flows (imports and exports) of 75 countries and regions worldwide. | Index |
| 18 | KPMG Supply Chain Stability Index (in association with ASCM) | United States | NA[D] | Measures the stability of supply chains using advanced analytics and based on 14 years of market data comprised of nearly 30 key variables and performance indicators. Four primary factors are considered: (1) the overall volume of goods shipped, (2) the speed at which goods reach their destination, (3) the cost of transporting goods from the source to the ultimate destination, and (4) the variability of these factors. | Overall index and 3 sub-indexes |
| 19 | Logistics Managers Index | United States | NA[D] | The Logistics Managers Index (LMI) tracks logistics activity in the U.S. as measured by a survey of supply chain professionals. | Index |
| 20 | Marine Exchange of Southern California | Southern California | Ocean container shipping | Provides extensive information on the shipping activities of the Ports of LA, Long Beach, Port Hueneme and San Diego. | Count of ships in queue at ports |
| 21 | National Retail Foundation Global Port Tracker | United States | Ocean container shipping | Provides a six month rolling forecast of imports at 16 major container ports across North America. | Forecast of monthly imports of 20 foot TEUs (twenty foot equivalent containers) |
| 22 | Oxford Economics: US Supply Chain Stress Tracker | United States | NA[D] | Aggregates numerous supply-side data and divides it into 5 main categories: activity (e.g., manufacturing capacity utilization), transportation, prices (for transportation, warehousing, commodities and final demand), inventory, and labor. | Index based averages of multiple metrics |
| 23 | Pacific Merchant Shipping Association | West Coast ports | Railroad and ocean container shipping | Provides wide variety of shipping data including the dwell times at west coast ports for cargo awaiting rail shipment. | Count of days waiting to be shipped by rail dwell time) |
| 24 | Ports of LA and Long Beach | LA and Long Beach ports | Ocean container shipping | Provides multiple monthly statistics including number of ocean containers handled. | Count |
| 25 | Regional Federal Reserve Bank Delivery Times Indexes | Various US Federal Reserve Bank District Regions (e.g., Dallas, Philadelphia, New York, Richmond, Kansas City) | NA[D] | Based on local surveys, reports the change in delivery times from factories compared to the previous month for reporting manufacturing firms. | Indexes |
| 26 | Sea Intelligence | Global | Ocean container shipping | Evaluates ocean liner schedule reliability and capacity utilization. | Reports |

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[E] There are ISM Reports for many other geographies besides the United States which provide similar information on these geographies.

Source: Author

TABLE 1 Continued...

## Selected supply chain macro indicators and their sources firm

| | Provider or source of measure or indicator | Geography covered | Transportation Modes covered | Description of the supply chain component monitored | Type of measure or indicator |
|---|---|---|---|---|---|
| 27 | Shanghai International Port Group | Shanghai (world's largest port) | Ocean container shipping | Reports the container volumes and weights processed per month. | Index |
| 28 | Statista – Global Supply Chain Pressure Index | Global | Ocean container shipping | Provides a monthly global index on the rates for 40 ft containers as well as individual indexes on major lanes such as China to the US East Coast. | Multiple indexes |
| 29 | The Shanghai Containerized Freight Index | Shanghai | Ocean container shipping | Reflects the fluctuation of spot freight rates on export container transport market from Shanghai. | Index |
| 30 | Truckstop.com Market Demand Index | United States | Trucking | Reports weekly on the ratio of load postings to truck postings in the system for all types of shipments (dry vans, refrigerated and flat beds). Provides insights on capacity and spot market pricing. | Multiple indexes |
| 31 | USDA – Barge Rates on Mississippi | Mississippi River | Barge transportation | Provides a variety of barge performance indexes such as rates, capacity, tonnage moves in total and by key commodities. | Multiple indexes |
| 32 | US Bureau of Labor Statistics Air Freight Index | Imports/Exports into and from the United States | Air freight | Publishes two types of international air freight price indexes—import/export and inbound/outbound. The Inbound and outbound air freight indexes are directional and measure price trends for the transportation of freight between the United States and foreign countries. | Multiple indexes |
| 33 | US Bureau of Transportation - DOT Transportation Supply Chain Indicators | United States | All modes of transportation | An interagency working group provides information on all forms of transportation modes and activities organized into the following four categories: (1) Port congestion - inside the gate, (2) Port congestion - outside the gate, (3) Freight movements, and (4) Transportation labor and capacity tightness. | Multiple indexes and indicators |
| 34 | Xeneta Shipping Index | Global | Ocean container shipping | Reports daily ocean rates for 40 ft containers. | |

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[B] Is operated in cooperation with the Baltic Exchange. Note also that Freightos indicates they plan to offer an air freight index in the near future.

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Source: Author

time, to enhance the readiness and responsiveness of the firm's supply chain through these innovative efforts.

3. ***Utilize analytic methods to estimate the correlation and the impact of changes in macro indicators to changes in the key performance measures and the actual performance levels and costs of the individual firm.***

Utilizing various analytic techniques such as analysis of variance, regression, simulation, and other advanced methods; a firm can evaluate the correlation and/or causal relationships between external macro indicators and its own individual activities (and measures) critical to its own performance (e.g., supplier lead times and ocean freight costs). These types of analytic initiatives

## EXPLAINING THE HSCP FRAMEWORK

*The hierarchical supply chain performance (HSCP) framework presented here provides a generic, hierarchical structure with which a firm can organize the performance measures of its major supply chain functional areas such as distribution. This framework can be applied to any functional area, and the strategic, tactical, and operational levels can be categorized as a particular firm may define them. Thus, this HSCP framework offers a flexible format, adaptable to any supply chain organization. It does not prescribe or define any specific performance measures, but rather provides a standard format for a firm to organize and review them.*

*It is also important to note that this framework is not a substitute for, or alternative to, the well-known SCOR (Supply Chain Operations Reference) model associated with the Association for Supply Chain Management (ASCM). In contrast to the HSCP framework, the SCOR model is a broad process model designed to improve the effectiveness of supply chain management. Per the ASCM, the SCOR model "links business processes, performance metrics, practices, and people skills into a unified (hierarchical) structure" and it offers defined performance measures that a firm can employ. Thus, the SCOR model and the HSCP framework can be used as complementary tools. The interested reader is referred to the ASCM (apics.org/apics-for-business/frameworks/scor) for detailed information on the SCOR model.*

are generally customized for an individual firm and are the subject of current academic research. (To learn more, we would point you to Liberatore and Miller (1998) for an illustration of how a firm can create its own internal logistics performance index utilizing analytic techniques.)

## Conclusion

In this article we have reviewed two important and complementary tools to support a firm's supply chain performance measurement system. First, we presented a hierarchical framework that a firm can employ to organize all its performance measures which monitor (and facilitate managing) its operations. Second, we illustrated a category of what we termed "macro indicators." These indicators provide a firm with data and perspectives on the current operational status and performance level of supply chain activities beyond the direct control of the firm; activities which can heavily affect the firm's operations.

In conclusion, a supply chain organization that focuses on: (1) developing and maintaining a good HSCP framework, and (2) incorporating pertinent macro indicators into its measurement systems, can significantly improve its overall supply chain planning process. We strongly recommend that any firm not currently employing these planning tools invest in their development. •

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Portions of this article are excerpted from *"Logistics Management: An Analytics-Based Approach,"* 2020, and *"Supply Chain Planning: Practical Frameworks for Superior Performance, Second Edition,"* 2021.