

Aligned and Optimized

All too often considerable managerial resources are directed toward planning activities and processes with little in the way of tangible results. That's because their supply chain strategy is not aligned with the business strategy. Here are proven, practical techniques used by the authors to align and optimize supply chain operations management and planning in private industry. Call it: **The Power of Frameworks.**

BY TAN MILLER AND MATTHEW J. LIBERATORE

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In today's competitive global economy, a firm's market position and financial performance is closely linked to its supply chain performance. All too often, considerable managerial resources are directed toward planning activities and processes that deliver little in the way of tangible results and beneficial outcomes. What supply chain executives want is the know-how to efficiently and effectively direct their planning activities so that the results lead to better business decisions from the long-term down to day-to-day operations. What they often end up with is a set of unaligned decision-making processes that result in uncoordinated, inefficient planning and operations.

There is a better way: using Supply Chain Frameworks to oversee and guide planning and operations. Supply Chain Frameworks organize and manage all supply chain activities and decisions as a set of "linked" steps and processes that are part of one unified system, enabling managers to achieve high levels of operating effectiveness and efficiency.

In this article, we present proven, practical management frameworks and techniques that we used to support supply chain operations management and planning in the private sector. These frameworks provide methodologies for organizing and managing critical activities such as supply chain strategic planning and project selection, integrated manufacturing and distribution planning, performance measurement and warehouse planning and operations, to name a few.¹

¹ For highly detailed descriptions of implementations of all these and many other frameworks, and other related planning aspects such as feedback loops, see Liberatore, M. and Miller, T., *Supply Chain Planning: Practical Frameworks for Superior Performance*, Business Expert Press, New York, 2012, ISBN-13: 978-1-60649-316-8 (paperback), ISBN-13: 978-1-60649-317-5 (e-book). In this article, we will present an overview of the generic framework methodology and summaries of two specific examples.



We also illustrate how managers can and should employ planning frameworks to organize and manage all major supply chain functions and activities. While a firm clearly must have a framework to guide its overall supply chain strategic planning process, so too should the firm have a well-established planning framework for its individual supply chain functions such as transportation, manufacturing and logistics. Further, and most critically, all these supply chain planning frameworks must support and align with the firm's overall business goals and objectives.

Why are supply chain frameworks critical to a firm's success?

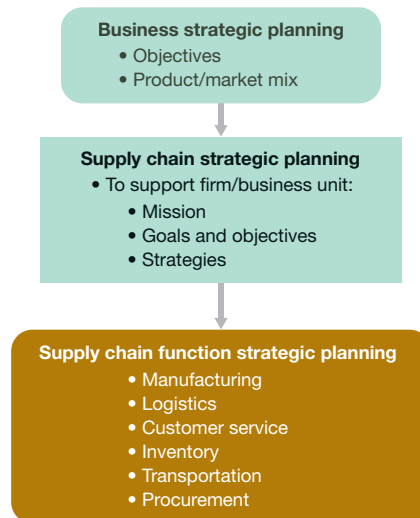
A supply chain framework is a formal planning system that organizes and links all supply chain activities. The first step in developing a supply chain framework is to "diagram or map" all the major activities and components of a firm's supply chain planning and execution systems. This allows managers to better understand how all the components of the system affect each other.

Firms that actively employ supply chain planning frameworks as a standard business practice give themselves a true competitive advantage. By embracing the methodologies and discipline fostered by a framework-based approach, firms make themselves agile, and are therefore capable of effectively and rapidly responding to ever-changing business conditions.

Leading edge characteristics of these firms include the ability to link and coordinate their planning activities and actions from the long-run, strategic horizon to the medium-term tactical and short-run operational horizons. The linkages between planning levels is hierarchical, meaning that plans developed at the strategic level guide and direct the tactical level, and plans developed at the tactical level guide and direct the operational, or execution, level, so that all plans and actions are in alignment with the firm's high level strategy. This overarching hierarchical perspective provided by well-implemented supply chain planning frameworks

FIGURE 1

Integrated business and supply chain strategic planning framework



Source: Authors

facilitates improved decision making, higher customer service levels and improved operating efficiencies for firms.

To set the stage for the remainder of this article, we now introduce two "linked" frameworks:

- 1 a business and supply chain planning framework; and
- 2 a supply chain function planning framework.

A business and supply chain planning framework

Figure 1 presents a simple framework depicting an integrated process where a firm's overall business goals and objectives define its supply chain organization's goals and objectives. Specifically, in its business strategic planning process, a company must

address such key issues as overall corporate objectives, market share and profitability goals, and business and product mix targets. Strategic planning decisions relating to overall corporate objectives then drive strategic supply chain plans and decisions. For example, market share and product mix objectives will strongly influence a firm's supply chain capacity and service strategies. A desire to increase market share may translate into a requirement that a firm expand its manufacturing capacity.

Other high-level supply chain strategies are also developed at this stage to support business goals and objectives. Examples of such strategies would include setting targets for overall customer service levels and maximum inventory investment levels, and creating key customer strategic initiatives.

Once a firm's supply chain planning team has established its high-level strategies, the functions within this organization must then develop and implement their individual strategies. As Figure 1 depicts, functions such as manufacturing, logistics and transportation each must plan their own strategies to support overall supply chain goals and objectives, and ultimately those of the business. For example, the manufacturing organization's plans must address such issues as planned production capacity levels for the

next three years and beyond, the location and number of facilities its plans to operate, and so on. Other functions such as logistics, transportation and procurement will face different but similarly critical issues and decisions. Shortly, we will review in greater detail what we describe as an integrated business and supply chain planning framework. For now, however, as illustrated in Figure 1, this integrated strategic planning process consists of three components:

- 1 business strategic planning, which drives and guides;
- 2 supply chain strategic planning, which drives and guides; and
- 3 strategic planning by individual supply chain functions.

The distinction between steps 2 and 3 is as follows: In step 2, the senior leaders of the supply chain organization (i.e., the leaders of all the individual supply chain functions) collectively establish the high-level strategy for their organization, while in step 3, each individual supply chain function (e.g., manufacturing) develops a strategic plan for its own organization that supports the overall supply chain plan generated in step 2.

To illustrate this integrated process, consider the following brief example. Let's assume that the business unit strategic planning process results in a decision that production capacity should be increased by 40% over the next five years to support planned sales growth (step 1). The supply chain strategic planning team receives this input, and its planning process (step 2) then determines that the firm will generate this capacity increase through internal expansion rather than using third party contract manufacturing. Plans developed at the overall supply chain level may be more specific—such as a general decision that capacity should be added specifically in Southeast Asia. The level of detail specified in step 2 will vary by firm. Next, in step 3, the manufacturing group engages in its individual strategic planning process. At this level, manufacturing generates a detailed strategy addressing such issues as the specific location where it will build additional capacity, the technology planned for the facility, and the targeted labor versus automation mix. Similarly, each other major supply chain function such as transportation will also conduct its strategic planning process in support of the overall supply chain strategic plan. This completes the three-step integrated business and supply chain strategic planning framework.

We next introduce a framework for individual supply chain function planning where the planning process

becomes much more detailed. To accommodate the granularity required at this level, each supply chain function must utilize a hierarchical planning framework that can address all issues ranging from the long-run strategic to the short-run operational.

A hierarchical supply chain planning framework

The planning activities and decisions that management must make for a supply chain function range from those requiring vast resources and managerial time (as measured by cost, required planning inputs, level of risk and other attributes) to those requiring relatively minimal time and resources. For example, consider the vast differences in the required inputs for, and implications of, a plant location and sizing decision versus a one-week production line scheduling decision. To effectively address this broad spectrum of management and operational control activities and decisions required in any major supply chain function (e.g., manufacturing), it is necessary to separate the future planning horizon into three buckets:

- strategic planning;
- tactical planning; and
- operational planning.

These three planning horizons must be closely and hierarchically linked to ensure aligned decision making.

A generic framework for supply chain planning and management

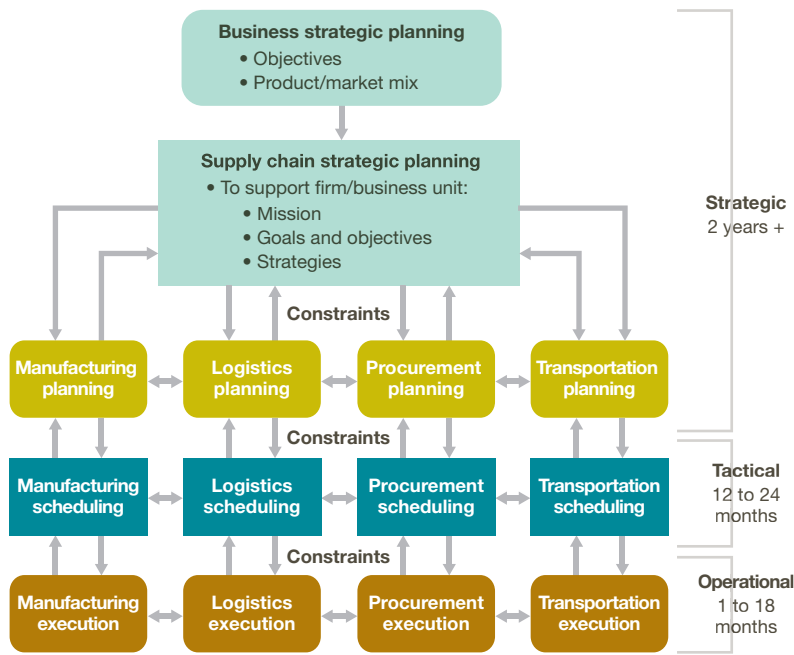
Now we link the strategic business and supply chain planning framework and the hierarchical supply chain planning framework to form the unified business and supply chain planning framework displayed in Figure 2.

We describe this framework as generic because it illustrates how the planning activities of any individual supply chain function can (and should) be linked into the overall business and supply chain strategic planning process of an organization. The definition of what constitutes a major individual supply chain function will vary by firm. For example, some firms may consider transportation and/or customer service as components of their logistics organization, while other firms may not. Regardless of how many functions within a supply chain organization a firm chooses to define as major individual units, the framework in Figure 2 provides a well-defined, holistic organizational approach.

As described previously, this framework begins with the

FIGURE 2

A unified business and supply chain planning framework



Source: Authors

will have more than four major supply chain functions. Finally, in Figure 2 also note the following:

- 1 There are bidirectional vertical lines between the strategic, tactical and operational planning levels of each supply chain function (e.g., manufacturing). A line emanating from a lower level to a higher level is known as a “feedback loop” in a hierarchical planning system.
- 2 There are horizontal lines between the individual functions. These lines illustrate that in practice, interactions in many forms should (and do) occur between individual supply chain functions. These interactions can be both formal (e.g., joint planning sessions)

business strategic planning and then the supply chain strategic planning processes. The outputs of these processes generate high-level requirements and define capabilities that the individual functions within supply chain must then deliver. Further, the outputs of this process may also identify projects that can best help to achieve the plans developed at this overall supply chain level. At this point, individual functions such as manufacturing must initiate their own planning processes to map out the respective contributions that they will make in support of the overall supply chain plan.

At the individual function or department level, it is beneficial to delineate the future planning horizon into strategic, tactical and operational planning buckets. Thus, each supply chain function has its own three level planning process.

To illustrate the different types of decisions and management controls exercised at each planning level, note in Figure 2 that at the tactical level we use “scheduling” as a function descriptor, while at the operational level “execution” is the function descriptor. In practice, at the tactical level one observes both planning and scheduling activities, while at the operational level, planning, scheduling and execution activities all occur. Note also that while Figure 2 shows only four supply chain functions for illustrative purposes, some firms

and informal (e.g., day-to-day communications).

In summary, the generic supply chain planning framework depicted in Figure 2 facilitates a firm-wide planning process whereby strategic plans initially formulated at the business unit level receive aligned planning, scheduling and execution support all the way down to the operational level of each individual supply chain function.

Decision support systems and performance metrics

Now that we have introduced a unified, integrated process for business and supply chain planning, we need to discuss some key planning and control tools to facilitate this process. In this section, we briefly introduce two essential tools of a firm’s planning and control processes:

- 1 decision support systems, and
- 2 performance measurement systems.

Decision support systems (DSS) for supply chain planning span a broad array of methodologies and techniques ranging from data base analyses and data mining to simple spreadsheet based analyses, to sophisticated mathematical optimization and simulation models, and statistical analyses. It is important to recognize that a firm must develop and maintain DSS tools to support activities at each level of its planning horizon (i.e., the strategic, tactical and operational levels).

Performance measurement systems provide managers with indicators of how efficiently and effectively their supply chain is operating. Additionally, good performance measurement systems (PMS) also offer advance warnings or indications of potential future problems on a supply chain. A good PMS is also an absolute necessity to support the planning frameworks of a supply chain organization.

Figure 3 depicts the integral role that decision support and performance measurement systems play in the business and supply chain planning framework.

As illustrated, each individual supply chain function must have appropriate DSS tools at each level of its planning process. Similarly, each function must also have pertinent performance metrics to monitor its activities. And collectively, the supply chain organization must have the DSS and PMS tools required to manage the entire process.

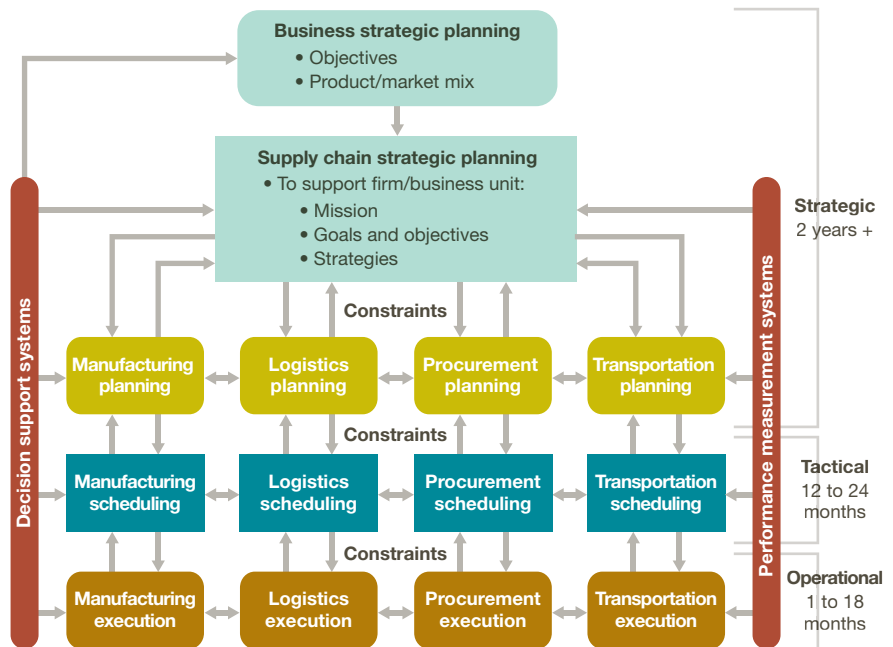
A firm with good supply chain frameworks, but which lacks the proper DSS and PMS tools cannot succeed. Similarly, a firm with strong DSS and PMS capabilities, but which lacks the appropriate supply chain frameworks to organize and utilize these tools cannot succeed. Only the combination of good supply chain frameworks, complemented by strong decision support and performance measurement systems, will facilitate effective supply chain planning and successful operations. To conclude this article, we next present two examples of “functional” hierarchical supply chain planning (HSCP) frameworks and systems.

A warehouse planning and operations example

The warehouse planning process begins at the network-wide strategic planning level where a firm must determine how warehouse operations fit into its overall strategic plan. Figure 4 provides a high-level overview of this hierarchical planning process that begins at the strategic level.

FIGURE 3

DSS and PMS integration into business and SC planning framework



Source: Authors

A first step in the planning process consists of determining the mission of the overall warehouse network and the individual locations that will make up the network. As is well known, not all warehouses on a network will necessarily have the same mission or play the same role. The number of warehouse echelons to establish represents another common strategic network design question that heavily influences the mission of individual warehouses.

For example, a firm must decide whether it will operate a single echelon network in which every warehouse will receive shipments of all products directly from all plants, or alternatively does the firm want to operate a multi-echelon warehouse network where one or more first echelon, central warehouses receive products from plants and then redistribute some or all products to second echelon regional warehouses. Another important strategic decision concerns the question of whether a firm chooses to operate its own facilities or to outsource some or all of its warehouse operations to third party providers. Finally, as Figure 4 illustrates, total network warehouse capacity requirements and the economies of scale trade-offs are two additional key determinants of the interrelated decisions on network design, facility design and warehouse

technology selection.

At the tactical level, a firm must concern itself with such planning activities as balancing the demand for warehousing capacity across its network, and planning the most efficient and effective utilization of its capacity at each individual DC. Capacity planning at the individual DC level can involve determining the overall labor level and mix required to meet the projected demands over the planning horizon, the proper mix and use of available storage locations (e.g., type of racking where adjustable), and so on.

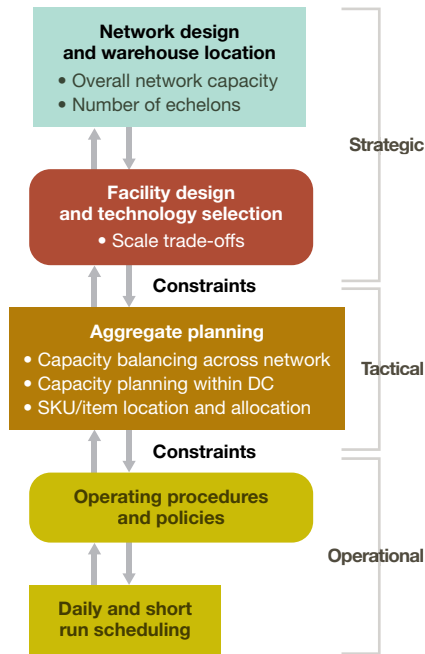
In general, tactical warehouse planning focuses on the determination of how to best employ the existing network infrastructure (i.e., the existing warehouses and materials handling equipment).

Additionally, decisions to purchase relatively minor additional warehousing assets (e.g., incremental material handling equipment, racking, etc.) will occur in the tactical planning process. Major infrastructure issues that a firm cannot resolve at the tactical planning level (e.g., inadequate network capacity to meet forecast long term warehouse

throughput or storage requirements) must typically be fed back up to the strategic planning level for resolution. Thus, the efficacy of hierarchical warehouse planning and scheduling relies upon feedback loops, as do most supply chain functions.

At the operational level, a broad assortment of warehouse planning and scheduling activities takes place on a regular basis. Figure 5 illustrates a sample of key decisions that operational schedulers must address. The scheduling

FIGURE 4
Hierarchical warehouse planning

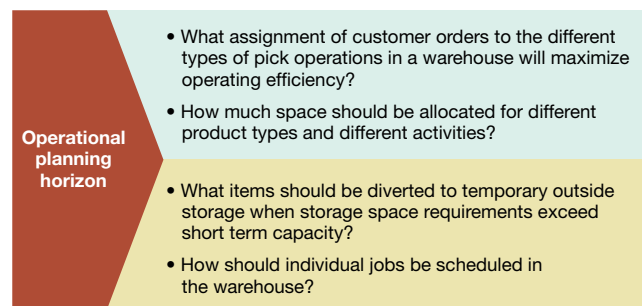


Source: Authors

of labor and short-term assignments of items to storage locations represent two of the major operational planning activities. Typically, it is the non-routine components of these activities (e.g., addressing temporary storage requirements that significantly exceed capacity) that require the most critical attention. It is also typically the exceptions or non-routine requirements of operational planning and scheduling that planners must report, or “feed back,” to the tactical planning level.

For example, when warehouse planners consistently find themselves having to schedule unplanned outside storage because of insufficient facility storage capacity, they should send this information to the tactical level for resolution. Perhaps the overall warehouse network is out of balance and requires re-

FIGURE 5
Illustrative operational warehousing decisions



Source: Authors

alignment because excess storage capacity exists at certain warehouses, while other warehouses face the opposite situation. Alternatively, perhaps this storage capacity issue at one warehouse is not an imbalance issue, but rather is occurring regularly across the network and requires a total network solution. This represents just one simple example of the feedback loops that must exist between the operational and tactical warehouse planning levels.

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A manufacturing planning and operations example

In our illustrative hierarchical manufacturing and distribution planning framework, business unit strategic plans have been developed and approved, as have the high level strategic plans of the overall supply chain. Now

the manufacturing and distribution functions commence their own strategic planning processes to support the overall supply chain and business unit strategies.

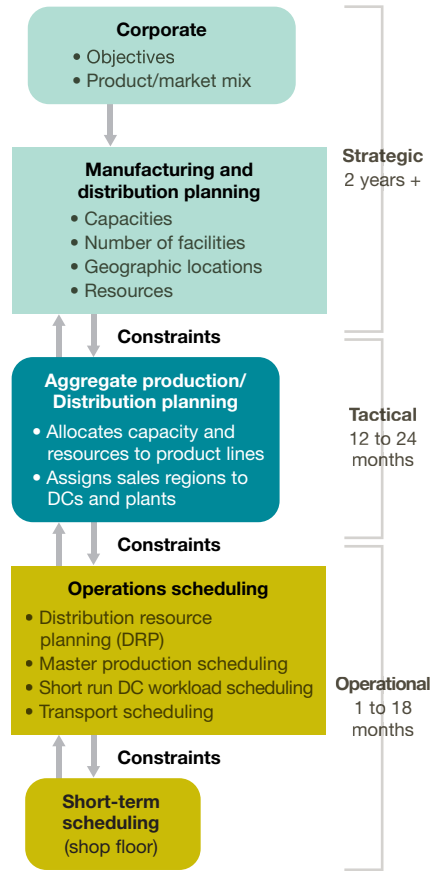
At the strategic manufacturing planning level, the company must address such issues as planned production capacity levels for the next three years and beyond, the number of facilities it plans to operate, their locations, the resources the company will assign to its manufacturing operations and numerous other important long-term decisions.

Decisions made at the strategic level place constraints on the tactical planning level. Typical planning activities at the tactical level include the allocation of capacity and resources to product lines for the next 12 to 18 months, aggregate planning of workforce levels, the development or fine-tuning of distribution plans and numerous other activities. Within the constraints of the company's manufacturing and distribution infrastructure (an infrastructure determined by previous strategic decisions), managers make tactical planning decisions designed to optimize the use of the existing infrastructure.

Planning decisions carried out at the tactical level impose constraints on operational planning and scheduling decisions. At this level, activities such as distribution resource planning, rough cut capacity planning, master production scheduling, shop floor control scheduling and many other decisions occur.

As previously noted, the feedback loops from the operational level to the tactical level and from the tactical level to the strategic level represent one of the most important characteristics of the HSCP system illustrated in Figure 6. A true HSCP system is a closed-loop system that employs a top-down planning approach complemented by bottom-up feedback loops.

FIGURE 6
Integrated manufacturing and distribution planning framework



on evaluating capacity levels and imposing and/or communicating capacity constraints from higher levels down to lower levels, it is imperative that strong feedback loops exist.

As is well known, production and distribution plans that appear feasible at an aggregate level can often contain hidden infeasibilities that only manifest themselves at lower, more disaggregated levels. Without the proper feedback loops embedded into a hierarchical planning system, the danger that a company will attempt to move forward with infeasible plans always exists. These infeasibilities often do not surface until a company is in the midst of executing its operational plans and schedules.

Competitive and agile

In this article, we have described a planning methodology for supply chain managers that utilizes hierarchical frameworks to organize and align both individual supply chain functions, as well as an entire firm's planning and operations from the strategic level to the daily operational level.

The planning systems and components of these frameworks will vary based on the requirements of individual firms and their major functional activities. However, all hierarchical framework based systems share the common characteristic that they organize and synchronize planning activities and operations from the long run to the short run.

This comprehensive perspective and alignment facilitates efficient and effective planning and decision-making within a firm. All the methodologies and frameworks we present and reference can readily be implemented. Our experience has taught us that firms that place strong emphasis on these approaches make themselves significantly more competitive and agile relative to firms that under-invest in these areas. ☺☺