
The Demand Management Process

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Demand management is the supply chain management process that balances the customers' requirements with the capabilities of the supply chain. With the right process in place, management can match supply with demand proactively and execute the plan with minimal disruptions. The process is not limited to forecasting. It includes synchronizing supply and demand, increasing flexibility, and reducing variability. In this paper, we describe the demand management process in detail to show how it can be implemented within a company and managed across firms in the supply chain. We examine the activities of each sub-process; evaluate the interfaces with corporate functions, processes and firms; and provide examples of successful implementation.

A good demand management process can enable a company to be more proactive to anticipated demand, and more reactive to unanticipated demand.

The demand management process is concerned with balancing the customers' requirements with the capabilities of the supply chain. This includes forecasting demand and synchronizing it with production, procurement, and distribution capabilities. A good demand management process can enable a company to be more proactive to anticipated demand, and more reactive to unanticipated demand. An important component of demand management is finding ways to reduce demand variability and improve operational flexibility. Reducing demand variability aids in consistent planning and reduces costs. Increasing flexibility helps the firm respond quickly to internal and external events. Most customer-driven variability is unavoidable, but one of the goals of demand management is to eliminate management practices that increase variability, and to introduce policies that foster smooth demand patterns. Another key part of demand management is developing and executing contingency plans when there are interruptions to the operational plans. The goal of demand management is to meet customer demand in the most effective and efficient way.

The demand management process can have a significant impact on the profitability of a firm, its customers and suppliers.

Improving the process can have far-reaching implications. Having the right product on the shelves will increase sales and customer loyalty [1]. Improved forecasting can reduce raw materials and finished goods inventories. Smoother operational execution will reduce logistics costs and improve asset utilization. These improvements will be realized not only within the firm, but will extend to other members of the supply chain.

In this paper, we further develop a framework for implementing an efficient and effective demand management process. First, we provide a background on the eight supply chain management processes identified by The Global Supply Chain Forum. This background is important because demand management is one of the eight processes and it requires interfaces with the other seven. We then describe the strategic and operational processes that comprise demand management, including the sub-processes and their activities. In addition, we identify the interfaces with the corporate functions, the other supply chain management processes and other firms. Finally, we present opportunities for future research and conclusions.

Background

Supply chain management has received substantial attention from researchers and

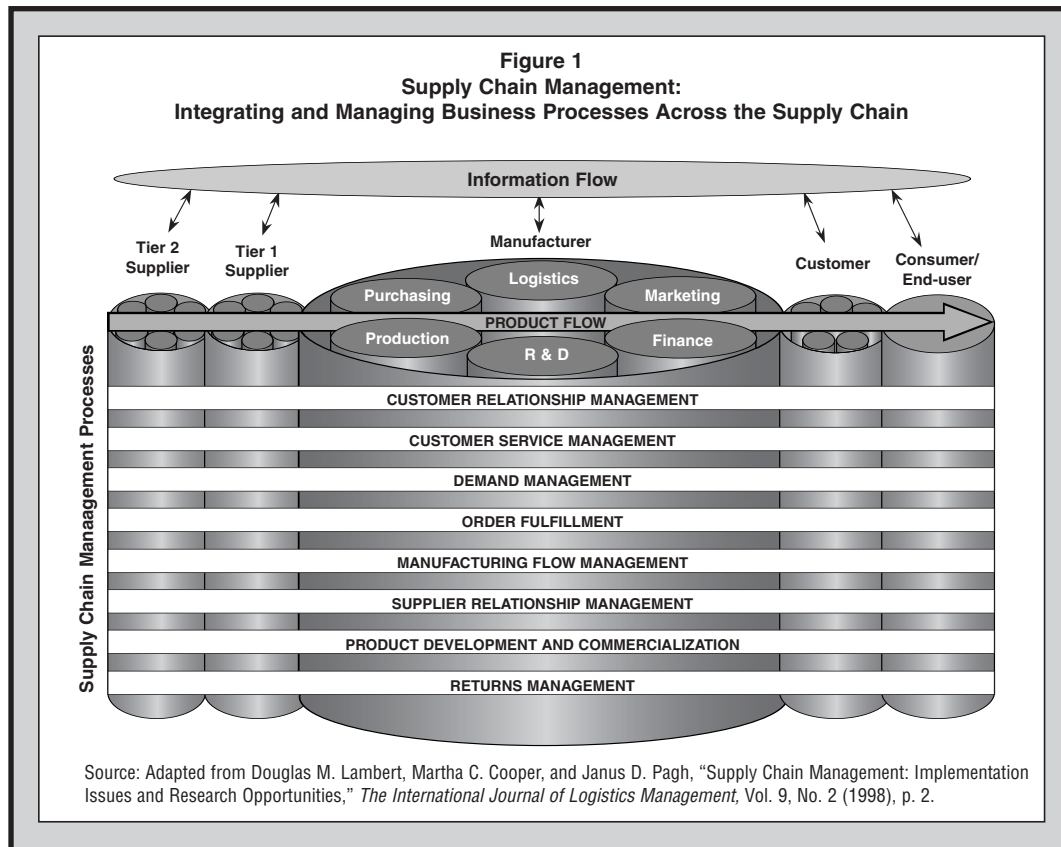
practitioners, yet in many companies management is struggling to implement supply chain management processes within their firms and across the supply chain. The Global Supply Chain Forum continues to develop the concept of supply chain management and the structure for its implementation. The definition of supply chain management developed and used by The Forum is:

Supply chain management is the integration of key business processes from end user through original suppliers that provides products, services, and information that add value for customers and other stakeholders [2].

The Forum members identified the following eight key business processes that need to be implemented within and across firms in the supply chain (see Figure 1):

- Customer Relationship Management - provides the structure for how relationships with customers are developed and maintained, including the establishment of product/service agreements (PSAs) between the firm and its customers.
- Customer Service Management - provides
- Demand Management – provides the structure for balancing the customers' requirements with supply chain capabilities.
- Order Fulfillment – includes all activities necessary to define customer requirements, design the logistics network, and fill customer orders.
- Manufacturing Flow Management - includes all activities necessary to move products through the plants and to obtain, implement and manage manufacturing flexibility in the supply chain.
- Supplier Relationship Management - provides the structure for how relationships with suppliers are developed and maintained, including the establishment of PSAs between the firm and its suppliers.
- Product Development and Commercialization – provides the structure for developing and bringing to market new products jointly with customers and suppliers.
- Returns Management – includes all activities related to returns, reverse logistics, gatekeeping, and avoidance.

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A process team comprised of managers from several functions including marketing, finance, production, purchasing and logistics, leads both the strategic and operational processes.

Each process cuts across firms in the supply chain and the corporate functions within each firm. It is through the customer relationship management and supplier relationship management processes that most inter-firm activities are coordinated.

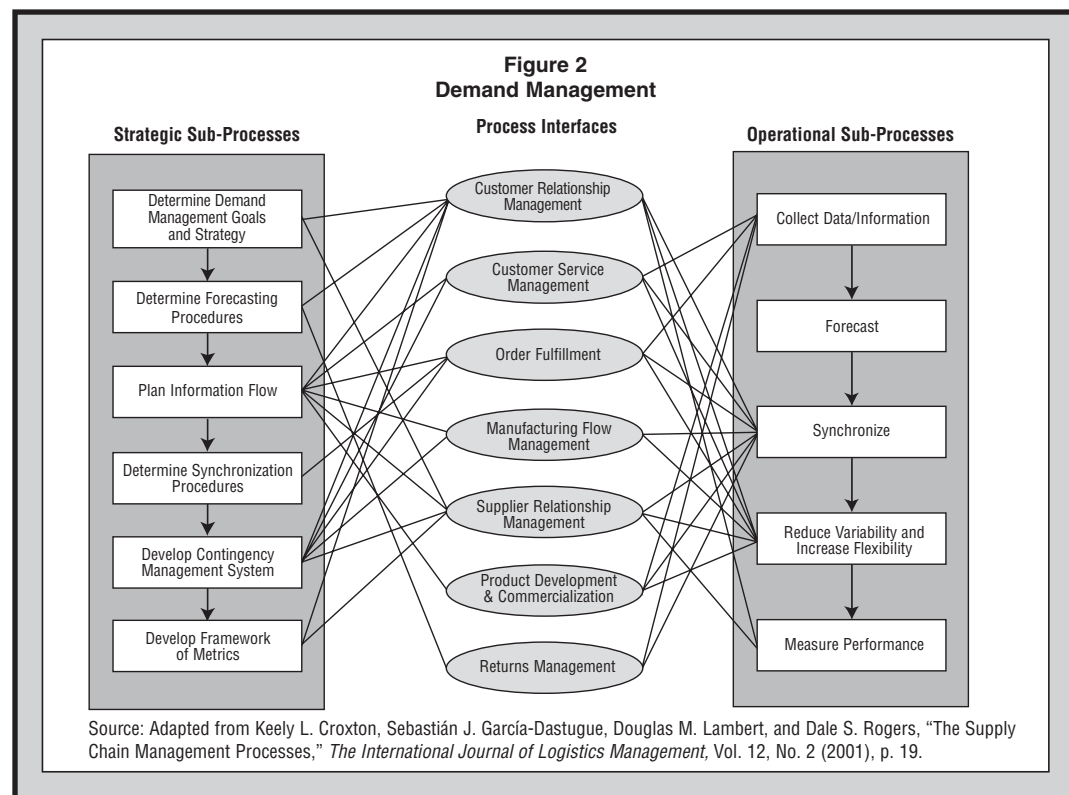
Croxtan et al. [3] further developed these eight processes. Figure 2 depicts the demand management process based on that research. In this paper, we examine the activities of each sub-process, identify the interfaces between functions, processes and firms, and look at examples of successful implementation. The framework presented is based on the literature and in-depth interviews with managers in a broad array of industries. In addition, it was further validated in four working sessions with members of The Global Supply Chain Forum over a period of 18 months.

Demand Management as a Supply Chain Management Process

The demand management process has both strategic and operational elements, as shown in Figure 2. In the strategic process, the team establishes the structure for managing the process. The operational process is the actualization of demand

management. Implementation of the strategic process is a necessary first step in integrating the firm with other members of the supply chain, and it is at the operational level that the day-to-day activities are executed. Figure 2 also shows the interfaces between each sub-process and the other seven processes. These interfaces might take the form of a transfer of data that other processes require, or might involve sharing information or ideas with another process team.

A process team comprised of managers from several functions including marketing, finance, production, purchasing and logistics, leads both the strategic and operational processes. The team might also include members from outside the firm. For example, the team might include customers as well as representatives from a key supplier or a third-party provider. The team is responsible for developing the procedures at the strategic level and seeing that they are implemented. This team also has day-to-day responsibility for managing the process at the operational level. Firm employees outside of the team might execute parts of the process, but the team maintains managerial responsibility.



The Strategic Demand Management Process

Demand management is about forecasting and synchronizing. The strategic process is comprised of six sub-processes that are aimed at designing an efficient operational system for matching supply and demand. Figure 3 shows the sub-processes, the activities that comprise each one, and the interfaces with the other seven supply chain management processes.

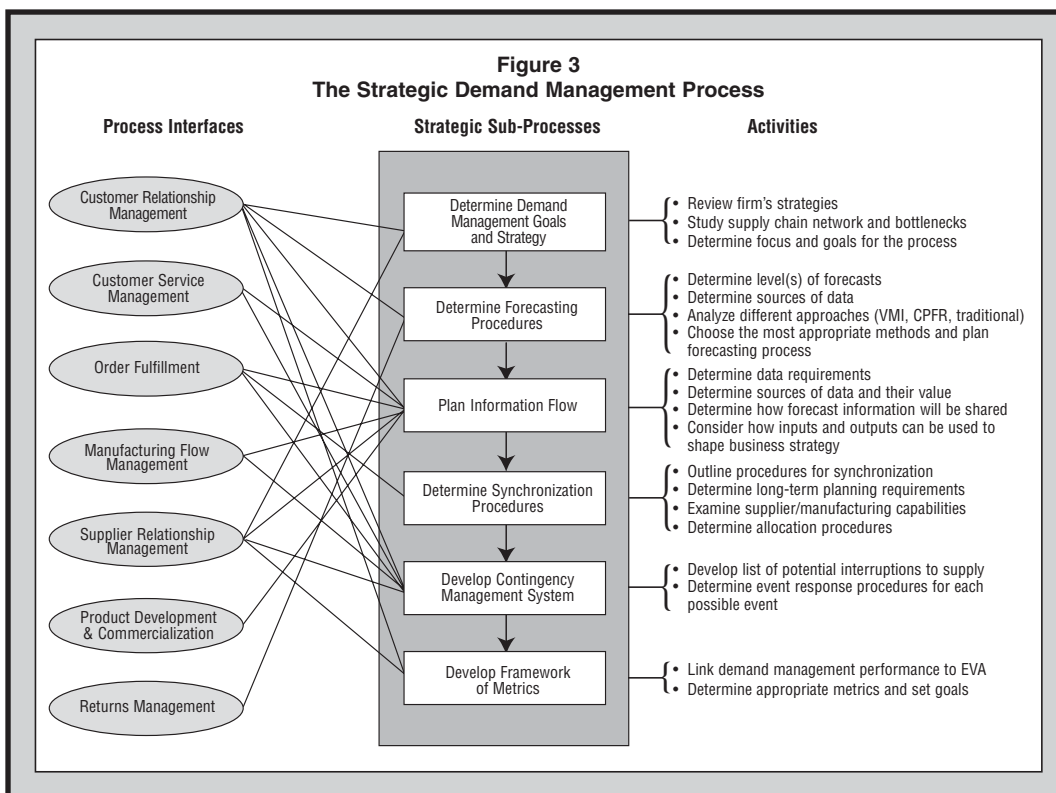
There is an abundance of technology on the market to help managers with components of the demand management process. The team needs to determine how the firm will use technology within the demand management process, and how information systems will need to be integrated with other members of the supply chain to facilitate the process. It is important that the technology solution is consistent with the expected benefits. Some firms will require more investment in information technology than others [4]. It is also critical that managers concentrate on the people and the procedures that make the technology effective and not rely simply on the technology.

Determine Demand Management Goals and Strategy

The demand management process is focused on predicting customer demand and determining how that demand can be synchronized with the capabilities of the supply chain. The process team must have a broad understanding of the firm's strategy, the customers and their needs, the manufacturing capabilities, and the supply chain network. In order to accomplish this, information is required from individuals in functions as well as the customer relationship management and supplier relationship management processes.

With this understanding, the process team can have a high-level discussion about the goals and the focus of the process, which may vary across different firms and industries. For instance, business in the telecommunications industry has become so unpredictable that Lucent Technologies, a global network provider, has decided to place priority on increasing flexibility in response to the demand, and put less focus on trying to accurately forecast it. In industries, where demand is more stable, reducing forecast error might be more cost effective than increasing flexibility. The discussion that the

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process team has in this sub-process will set the tone for how demand management is structured.

Determine Forecasting Procedures

In the second sub-process, the process team develops a critical piece of demand management; that is, forecasting. The team needs to select the appropriate forecasting approaches. This includes determining the levels and time frames of the forecasts needed throughout the firm, identifying the sources of data, and then defining forecasting procedures for each forecast required.

Different parts of the firm might need different levels of the forecast [5]. For instance, manufacturing planning might require an SKU-level forecast. Transportation planning, on the other hand, might need a forecast aggregated at the product-family level but disaggregated by region. Marien [6] suggested five levels of forecasting, all based on the time frame of the forecast. However, the decision should not be based solely on the time frame required. Other factors play a role, such as the units being forecasted and the use of the forecasts. Ross Products, a division of Abbott Laboratories and a market leader in pediatric and adult nutritionals, found that the forecasting needs of the entire firm could be met with three forecasts, one for operations, one for marketing and one for finance [7].

A firm might also use different forecasting procedures for new products or limited-time offers than they do for their standard products. For instance, the management team at a global beverage company recognized the difficulty in developing long-term forecasts for new products. Consequently, when introducing a new product, the forecasting team now works with key suppliers and the sales organization to develop a pipeline-fill forecast; that is, a gross sales figure for the duration of the supply chain lead-time. Based on cross-functional input and risk assessment, they determine an initial production quantity. This quantity is produced before the introduction of the product so that the beverage company can meet demand through the initial stage of the introduction. Once management observes the level of demand in the first few weeks, they can begin to generate a reasonably accurate forecast for the future.

It is important that these strategic decisions regarding the number of forecasts used are made collectively by a team of managers and that the resulting forecasts are coordinated. Although there might be several forecasts used in the firm, they should be consistent and represent one truth. If managers of each function develop their own forecasts independently, the firm will lose control over the forecasting process.

Next, the team determines the sources of the data required to generate each forecast. These might include historical data, sales projections, promotion plans, corporate objectives, market share data, trade inventory, and market research. In order to determine how to use these data, the team should understand the value of the information from each source; for instance, determining how good each source is at predicting demand.

It is at this point that the team might also consider Collaborative Planning, Forecasting and Replenishment (CPFR) or Vendor Managed Inventory (VMI) [8]. If these systems are being implemented, the customer is a direct source of data. If this is the case, the team needs to interface with the customer relationship management process team to determine what systems will be used to efficiently transfer data between the firms.

Once the team has an understanding of what type of forecast is needed, and what data are available, they can select a forecasting method and define a process to follow for each required forecast. There are many methods from which to choose, from quantitative, such as time series methods, to more people-driven, such as focus groups and the Delphi approach [9]. The appropriate method will depend on the environment in which the forecasting is taking place. In fact, different methods might be used for different products. In one of the companies interviewed, management segments products according to demand variability and demand volume in order to make decisions about the appropriate forecasting approaches. Each product is plotted using a two-by-two matrix as shown in Figure 4. The quadrant of the matrix in which a product is categorized will determine the appropriate forecasting approach. Quantitative methods based on historical data are used for products with low demand variability. Products with high

variability and high volume require more human input, perhaps from the sales force or the customers themselves. If a product has low volume and high variability, make-to-order production is used, which avoids the need for an SKU-level forecast and allows management to concentrate on an aggregated forecast for raw-materials or components.

After the appropriate forecasting approach is determined, the team selects the specific forecasting method. When making this decision, it is important for the team to understand the nature of the demand. For instance, if the demand is seasonal, they will want to select a method that incorporates seasonality. Should the team decide to use a quantitative approach like time series or regression, they might consider using forecasting software. There are numerous stand-alone software packages on the market that can handle the forecasting component of demand management and do not require significant financial investments [10]. It is important that the capabilities of the software package align with the forecasting needs of the firm. Considerations when selecting a software package include the span of statistical

methods that the system uses, the ability to adjust the forecast, the ability to use the software in a collaborative mode (either internally or externally), and the sophistication of the output reports that are offered [11].

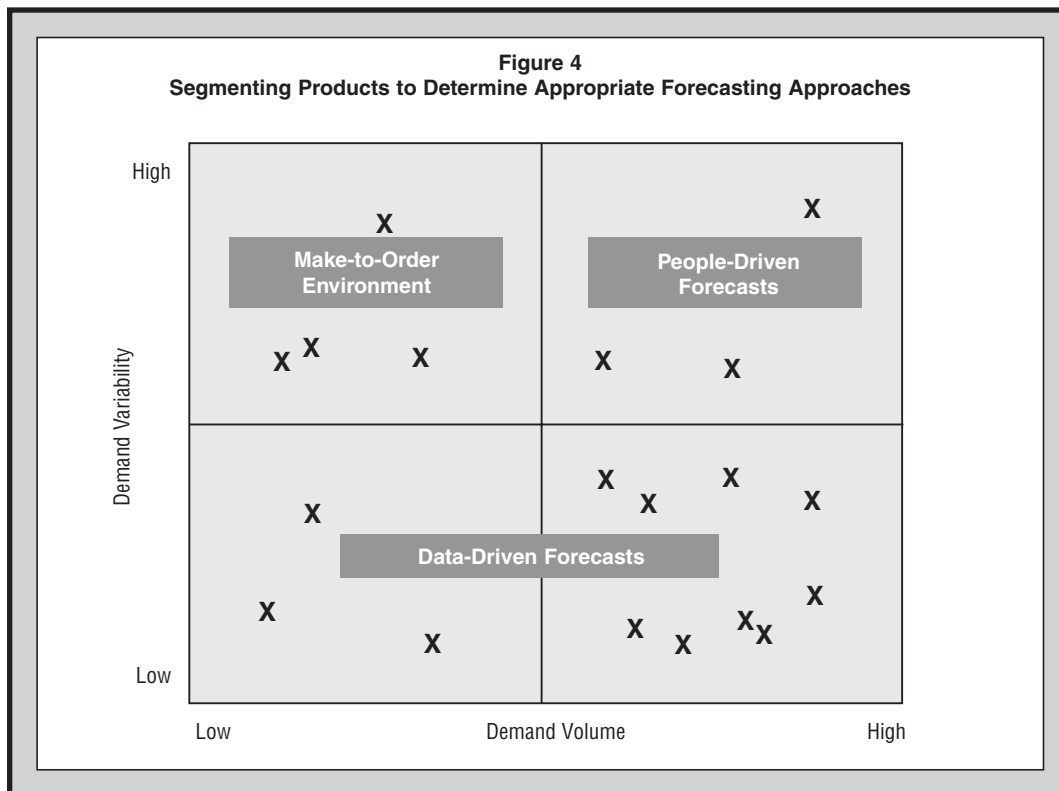
The team also needs to determine how often the forecasting procedures will be reevaluated. For instance, if the nature of the demand changes or the forecast errors begin to worsen, the team will need to convene and make necessary changes to the procedures being used.

Plan Information Flow

Once the team decides on the method of forecasting and the sources of data, they plan the information flow; that is, they determine the sources of data, how this input data will be transferred, and what output needs to be communicated to whom. Input to the forecasting process will likely come from several functions, the customer relationship management process, and in a CPFR environment, the customers themselves. The forecasts are communicated internally to the other process teams that are affected by them.

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what data will be shared with other members of the supply chain. For instance, in a CPFR environment, SKU-level forecasts are jointly developed with next-tier customers. Management might decide to share these forecasts in an aggregated form with suppliers, perhaps including key second tier suppliers. For example, Wendy's International, a quick service restaurant chain, shares its forecasts with both the lettuce processors and the lettuce growers.

The team also needs to consider if information systems need to be developed or enhanced in order to efficiently transfer appropriate information. Within a single firm, Enterprise Resource Planning (ERP) systems can provide consistent data that can be used throughout the company. In many cases, however, the demand management process needs information to flow between firms in the supply chain. For instance, information systems can be put into place to provide inventory visibility in the supply chain or manage the information flow of a VMI or CPFR implementation. Considerable effort is often required to integrate systems between firms. In some cases, web-based applications, which do not require integration of information systems between supply chain members, provide an effective means for sharing information with suppliers and customers. Companies like Moen Inc., the world's largest manufacturer of plumbing products, have developed applications to share forecasts, production schedules and inventory levels with their supplier base through the Internet. A web-enabled application can be a first point of contact for status reports.

As an extension to the information flow, the team should consider ways in which both the inputs and outputs of demand management can be used to define the future business strategy. Langabeer [12] differentiates the tactical use of demand information from its strategic uses. He argues that the same information that is used in the demand management process can be used to shape the marketing strategy and the direction the firm takes. For instance, analyzing demand and forecast data allows management to plan the life cycle of products, including the determination of when to introduce new products and phase

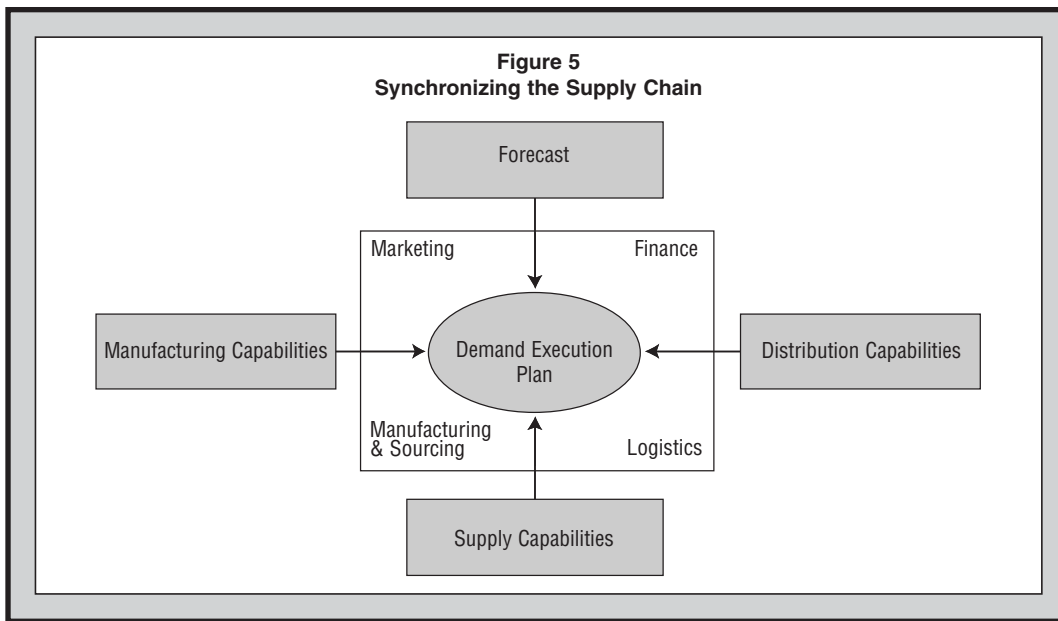
out existing ones. Data on where the bottlenecks in the supply chain are can be used in conjunction with product profitability reports to guide management on its investment strategies. The process team should look for ways to share insight that is gained as part of executing the demand management process with other key decision makers in the firm.

Determine Synchronization Procedures

Next, the team determines the synchronization procedures required to match the demand forecast to the supply chain's manufacturing, supply and logistics capabilities. Frequently, this is referred to as sales and operations planning (S&OP). As shown in Figure 5, the synchronization requires coordination with marketing, manufacturing and sourcing, logistics and finance. When executed at the operational level, this synchronization process includes examining the forecasted customer demand and determining the requirements back through the supply chain. It requires not only understanding the level of demand, but also the velocity at which product is required at each touch point in the supply chain. The output of this synchronization will be a single execution plan that will balance the needs and costs of manufacturing, logistics, sales, and the suppliers to meet anticipated demand. This execution plan will provide the basis for the detailed manufacturing and sourcing plan that is developed within the manufacturing flow management process through manufacturing requirement planning (MRP), and the detailed distribution plan that is developed within order fulfillment through distribution requirement planning (DRP).

At the strategic level, the team is responsible for developing the synchronization procedures that will be used at the operational level, including who will be included in the synchronization process and the structure for how they will meet. Some firms have a two-stage synchronization process whereby a cross-functional team of managers will meet, for instance monthly, to develop an initial demand execution plan. If there are any unresolved issues from this meeting, they will be directed to a meeting of upper-level managers who resolve them and sign-off on a final demand execution plan.

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Once a firm has an effective internal synchronization process, management should consider integrating key suppliers and customers directly into it. For instance, a beverage company includes internal suppliers in their monthly S&OP meeting. These suppliers are under the company's corporate umbrella, but they are different strategic business units and they have their own income statements and balance sheets.

Part of determining the synchronization procedures is defining policies about stockpiling and allocating; that is, where to stock inventory when supply is greater than demand, and how to reposition inventory when demand is greater than supply. These guidelines will be rather generic. Within the order fulfillment process, the customer-specific rules will be developed.

The team needs to gain a complete understanding of the capacity and flexibility available at key points along the supply chain. They also need to determine the long-term planning requirements, particularly in the case of demand with high seasonality or long-term changes, such as sustained growth. In the case of limited capacity and a product with seasonal demand, it might be necessary to ramp-up production several months prior to the high demand periods. At this point in the process, the team might also recognize future capacity issues and make recommendations to proactively address them before they cause problems.

It is important to realize that

different product-lines might use different synchronization procedures. For example, Moen Inc. has different procedures for core, custom and new products. The reason is that the focus of demand management changes for each classification of products. For new products, the focus is on attaining the most flexibility possible, as the demand of new products is the most uncertain. For Moen's core product-lines, management is interested in driving the costs out since products are mature and competitive price pressure is high. For custom products that are low-volume, the goal is asset optimization, which suggests an assemble-to-order system. When Moen used the same procedures for all products, they had problems because the goals of all three classifications could not be attained with one set of procedures. They moved to a differentiated system where the methods vary over the three classifications. In fact, even the organizational structure is differentiated; that is, different people are responsible for planning in each area.

Systems such as those provided by i2, Manugistics, and SAP [13] can be implemented to facilitate the synchronization process and help develop the demand execution plan. These systems are designed to examine the real-time constraints on the sources of supply and match them with the forecasted demand. Combining the functionality of information flow and synchronization, some of these systems can offer inventory deployment tools that provide

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real-time decision support for managing inventory in the supply chain. Although these systems are useful, they should be used in conjunction with human decision-making in a team setting. There are too many factors involved in the synchronization process to leave it entirely to an automated system.

Develop Contingency Management System

Another important component of the strategic demand management process is developing contingency plans to respond to significant internal or external events that disrupt the balance of supply and demand [14]. For example, how should the firm react if a manufacturing facility is unexpectedly shut down, or a port strike interrupts the flow of raw materials? Determining reaction procedures prior to the possible events will allow management to respond quickly in the case that one of these events occurs. In addition, the process team should consider what will be done if there is an interruption to any portion of data flow through the supply chain due to system errors.

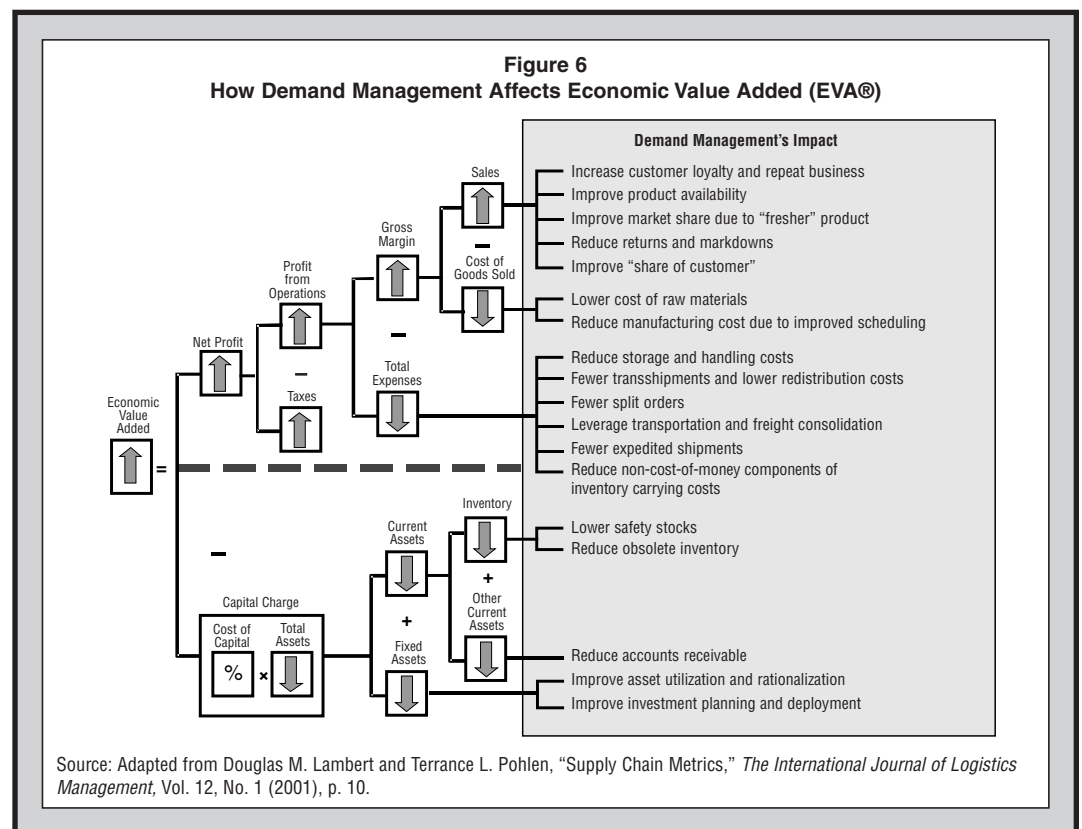
This contingency management system should be developed in accordance with the expectations of the customers outlined in the

customer relationship management process, and with input from order fulfillment, manufacturing flow management and supplier relationship management. Once developed, the contingency plans need to be communicated to the affected process teams.

Develop Framework of Metrics

Finally, the team develops the framework of metrics to be used to measure and monitor the performance of the process, and sets the goals for performance improvement. A uniform approach should be used throughout the firm to develop these metrics [15]. The team should start by understanding how demand management can influence key performance metrics that directly affect the firm's financial performance, as measured by economic value added (EVA) [16]. Figure 6 provides a framework for examining these relationships. It shows how demand management can impact sales, cost of goods sold, total expenses, inventory investment, other current assets, and fixed assets. For example, better demand management can result in higher sales by increasing customer loyalty and repeat business due to better forecasting and the associated customer

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service improvements. Also, improved product availability can lead to higher levels of retail sales and/or lower inventory carrying costs which can lead to a larger portion of the customer's purchases in this category. Product freshness results in better assortment and consumer appeal. A reduction in returns and markdowns can lead to the company becoming a more preferred supplier.

Cost of goods sold can be reduced as a result of lower cost of raw materials due to fewer expedited shipments and fewer last minute production changes by the supplier. Manufacturing costs can decrease as a result of improved scheduling.

A number of expenses can be reduced through better planning and scheduling that comes from less demand variability, including: storage and handling, transportation, order processing and the non-cost of money components of inventory carrying cost.

Better demand management can lead to lower safety stocks and less obsolete inventory which delivers higher inventory turns and lower inventory investment. Accounts receivable can be improved since fewer invoices will be disputed as a result of incomplete orders and missed delivery dates. Finally, better demand management can lead to lower fixed assets as a result of improved asset utilization and facility rationalization, and better investment planning and deployment.

Although these holistic metrics are affected by other activities and processes in the supply chain, the team responsible for demand management needs to estimate how this process impacts the firm's financial performance. Doing so will help to justify future investments in the process and to determine rewards for good performance.

Once the team has an understanding of the impact that demand management can have on financial performance as measured by EVA, metrics need to be developed for the activities performed and these metrics must be tied back to financial measures. Typical process measures for demand management include forecast error and capacity utilization. If steps are taken to actively reduce variability or increase flexibility, it is appropriate to include metrics that monitor the results of these activities, as well as to

measure how improvements in these non-financial measures affect financial performance. The role of the customers in reducing demand variability and the role of suppliers in increasing flexibility need to be measured and their contributions rewarded. The team needs to confirm these measures with the customer relationship management team to assure consistency across the firm.

Management should implement processes that positively affect the profitability of the supply chain as a whole, not just that of their firm. It is the goal of supply chain management to drive behavior that benefits the entire supply chain while sharing risks and rewards among its members. If management of one firm in the supply chain makes a decision that positively affects their firm's EVA but negatively affects the EVA of a key supplier or customer, the two firms should work out an agreement where the benefits are shared so that the bottom lines of both firms improve.

The Operational Demand Management Process

At the operational level, the process team must execute the forecasting and synchronization as it was designed at the strategic level. Figure 7 shows the five operational sub-processes, the activities within each of these, and the interfaces between processes.

Collect Data/Information

At the strategic level, the data requirements for developing the forecast were determined, and the information systems were put in place to facilitate this data collection. In order to collect the relevant data that were specified in the strategic process, the team must interface with the marketing function as well as the order fulfillment, customer service management, product development and commercialization, and returns management processes. When designing the forecasting system at the strategic level, important input comes from the customer relationship management team, but at the operational level, it is the order fulfillment and customer service management processes that provide the most relevant information on anticipated demand. The product development and commercialization

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process team provides information regarding the rollout of new products. Data from the returns management process are used for generating the forecast because it provides input to understanding the actual demand. If a forecaster only uses sales figures as a measure of past demand, and does not consider what was returned, the forecast will be based on inflated numbers.

Forecast

With all the required data in hand, the team develops the forecasts. It is important that they track and analyze the forecast error and incorporate this feedback to fine-tune the forecasting methods. This is an important component of the learning process associated with good forecasting. For example, at a global beverage company, managers examine forecast errors and perform a root-cause analysis when errors are unusually large. This analysis involves tracing the source of the unexpected demand (or shortage of demand) to see if it is a particular customer, brand, region, or product. Once the source is known, it is necessary to determine what the cause was and how long the change in demand will last. This provides a starting point for improving future forecasts.

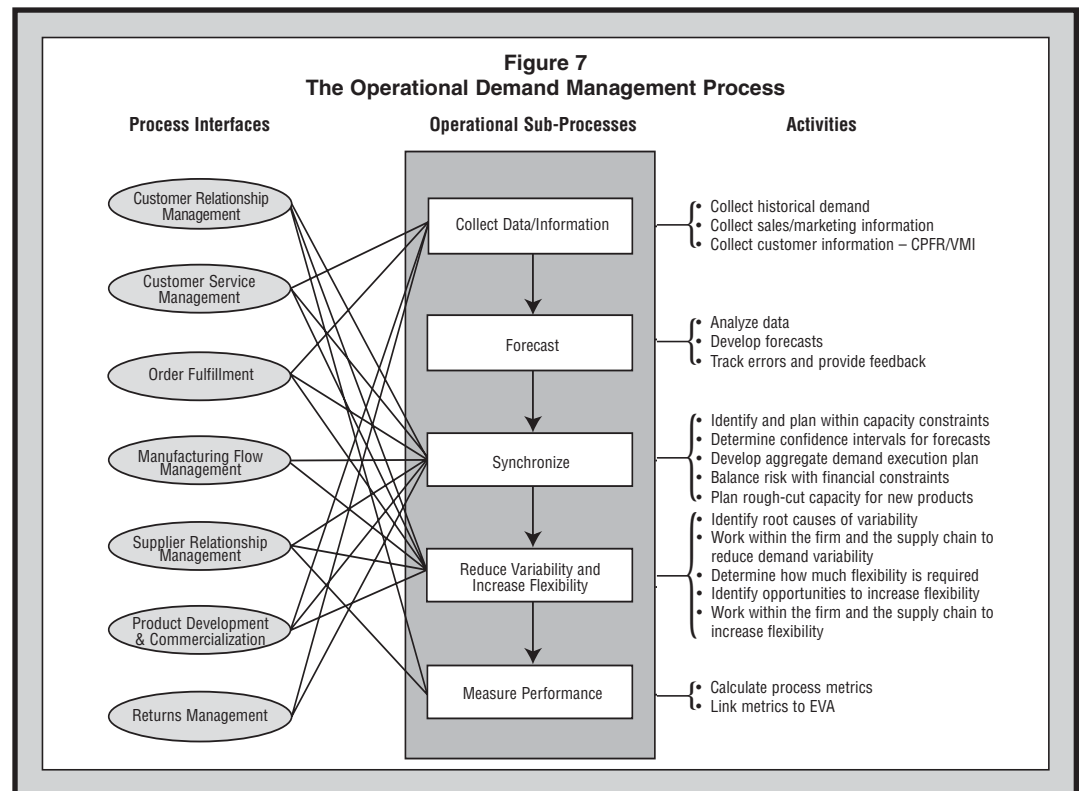
Synchronize

The forecast provides one input for matching demand with supply. This synchronization process follows the procedures determined at the strategic level. This is where the team turns the forecast into a demand execution plan (see Figure 5); that is, a plan for how the firm will meet the demand. In addition to the forecast, the team must consider capacities throughout the supply chain, financial limitations, and current inventory positioning (including saleable product that is being repositioned as a result of returns).

Understanding the capacity limitations requires the team to look both upstream and downstream. Ideally, the team should know both the capacity and the current inventory levels for key members of the supply chain. Comparing this information to the forecast will tell the team what constraints are in the system. Once the constraints are identified, the team can work with the other process teams to determine how to resolve the bottlenecks, or to allocate the available resources and prioritize demand.

Although most forecasting methods are focused on determining the point forecast, calculating confidence intervals can provide

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management with valuable information on which to base their decisions. Using past forecast error values, the team can calculate confidence intervals for the forecasts. For instance, a manufacturing firm might forecast the demand to be 100 units and the 95% confidence interval to be 80 to 120 units. This means they are 95% sure the actual demand will fall in this range. In addition to the point forecast, this range could be shared with suppliers to provide information that they can use for planning, or even to negotiate available capacity. Management can also use this information to determine how much demand they want to meet. To offer high customer service, they should produce 120, but if the cost of inventory or risk of obsolescence is high, they might choose to produce only 80. In order to make this determination, the team needs to understand the firm's cost structure and strategic objectives.

In addition to supply and manufacturing constraints, the forecast might introduce a financial constraint. In turning the forecast into a demand plan, the team might need to practice risk management. This is the practice of balancing risk with financial rewards. When it is not financially feasible to meet all the demand, management must decide how to most effectively allocate resources. The contingency management plans developed at the strategic level might also need to be considered if an internal or external event causes a disruption to supply or large forecast errors.

The team also develops a rough-cut capacity plan for any new products soon to be launched. At Moen, Inc., management not only determines existing capacities, but talks to key suppliers to understand how quickly they could respond if demand exceeds the forecast for a new product.

The output of the synchronization sub-process is a demand execution plan that includes aggregate production plans and inventory-positioning plans, which need to be communicated internally and to key members of the supply chain. Developing and communicating these plans requires interfaces with the customer relationship management, customer service management, order fulfillment, manufacturing flow management, supplier relationship management, and product development and commercialization processes.

Reduce Variability and Increase Flexibility

Many people see variability as the enemy of planning. It is easy to plan for the average, but it is the deviations from the norm that cause problems. Managers spend substantial time and money dealing with the consequences of demand variability. There are two things managers can do to minimize the negative impact of variability. One is to reduce the variability itself, and the other is to increase the flexibility to react to it. A key component of demand management is an ongoing effort aimed at doing both these things. Increasing flexibility helps the firm respond quickly to internal and external events and reducing demand variability aids in consistent planning and reduces costs.

Management should first try to reduce variability and then manage the unavoidable variability by building-in flexibility [17]. Flexibility usually comes with a price tag so it should not be used as a Band-Aid to fix problems that can otherwise be avoided. There are many sources of variability in the supply chain. One of the most problematic is demand variability. Many managers see demand as an uncontrollable input. Bolton states that demand management "actively seeks to ensure that the customer demand 'profile' that is the input into the demand-planning process is as smooth as possible" [18]. This is the difference between demand planning and demand management. Within the demand management process, the team should look for sources of variability and implement solutions to reduce it.

Table 1 provides examples of sources of variability and potential solutions. For example, the team might work with the customer relationship management team and help customers better plan promotions, or implement scheduled ordering policies [19]. The team might also find that internal practices are driving demand variability, such as end-of-quarter loads. If the demand for new products is highly variable, they could work with the product development teams to implement controlled roll-outs where the products are introduced first in test markets where demand patterns can be evaluated. In some scenarios, it could be the competition that is driving demand variability. For instance, demand could be affected by a competitor engaged in end-of-quarter loading

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or offering a promotion. In these cases, the variability is unavoidable, but can often be planned for when developing the forecast. "The supply chain which best succeeds in reducing uncertainty and variability is likely to be most successful in improving its competitive position" [20].

Gaining flexibility allows a company to better manage the system variability that cannot be eliminated – both anticipated and unanticipated variability. When a beverage company introduced one of its new products, demand was more than double the amount forecasted. Because management had developed a flexible system, they were able to manage through this without affecting customer service. Increasing flexibility can influence the reliability, quality, cost and speed of the process and its products [21]. The team should first determine how much flexibility is needed. Because building flexibility into a system is often expensive, it is important that the level of flexibility developed is consistent with the needs of the supply chain. To make this determination the process team needs to fully understand customers' needs, demand patterns, and the capabilities of the entire supply chain.

Once the team understands how much flexibility is needed, they should look for ways to attain it. This involves working with the other process teams within the firm, as well as with suppliers and customers to determine where there are opportunities to add flexibility into the supply chain. For example, the team might work with the manufacturing flow management team to find ways to introduce postponement into the manufacturing process, implement agile manufacturing practices, or find ways to multi-source [22]. They might work with the customer relationship

management team to stratify customers so that the firm can be most responsive to a small set of key customers, or work with the product development teams to standardize materials. The team might work with the order fulfillment team to make changes to the network, such as reducing lead-times or increasing capacity at buffers. Solutions might also exist from within the demand management process, such as implementing VMI.

In order to find ways to increase flexibility and reduce variability, the process team works with the sales, marketing and manufacturing organizations, customers and suppliers. To increase flexibility, they identify bottlenecks and pinch points, and develop cost-effective solutions. To reduce variability, the team highlights root causes and develops solutions that are consistent with the business strategy. Identifying these opportunities involves process interfaces with manufacturing flow management, supplier relationship management, customer relationship management and customer service management, as well as the corporate functions. In all cases, the team needs to consider the implications of the solutions on the other members of the supply chain.

Measure Performance

Finally, the process team is responsible for measuring the performance of the process with the metrics developed at the strategic level. These metrics are used internally to improve the process and are provided to the customer relationship management team and supplier relationship management team who will convey the firm's performance to the key members of the supply chain and generate the customer profitability and supplier profitability or cost reports [23].

Because building flexibility into a system is often expensive, it is important that the level of flexibility developed is consistent with the needs of the supply chain.

**Table 1
Sources of Variability and Possible Solutions**

Causes of Lumpy Demand	Possible Supply Chain Solutions
Consumer promotions	Plan promotions collaboratively with customers.
Sales metrics	Design consistent metrics that avoid actions such as end-of-quarter loads.
Credit terms	Revise credit terms with customer input to ensure that the terms of sale are not negatively affecting purchase patterns.
Pricing/Incentives	Work with sales/marketing to only offer incentives that truly increase long-term sales.
Minimum order quantities	Assure that all costs are included when calculating the appropriate minimum order size.
Long distribution channels	Incorporate demand volatility into network design decisions.

Research Opportunities

In this paper, we further developed the demand management process and provided a more in-depth explanation of the issues and activities involved in each sub-process. While we have clarified the process and started to provide a roadmap for its implementation, there are several research opportunities that remain:

- Further developing the strategies utilized in the synchronization sub-process; that is, understanding how to match supply and demand across members of the supply chain.
- Further developing the theory and implementation of product segmentation for determining appropriate forecasting approaches; perhaps by validating the framework presented in Figure 4.
- Studying the use of information technology and decision support systems to assist in the demand management process.
- Understanding the information flows between firms in the supply chain; that is determining what information should be shared with whom.
- Developing metrics that can be used to evaluate the performance of demand management beyond the borders of the firm.
- Implementing the demand management process across multiple firms in a supply chain, documenting implementation issues and how obstacles were overcome.

Conclusions

Demand management is an important component of successful supply chain management. A well thought-out implementation and seamless execution of the process can have substantial benefits on the firm's EVA through, for example, reduced inventory levels, improved asset utilization and improved product availability. It is not enough to forecast well and have a good operations planning system. Demand management should include finding ways to reduce demand variability and increase operational flexibility, and implementing a good contingency management system so that the firm can quickly react to unplanned issues.

Although it is possible to implement many portions of the demand management process without going outside the four walls of the firm, the real opportunities come when

management reaches out to the other members of the supply chain and integrates this process with the processes of suppliers and customers. It is through these integration efforts that the benefits of supply chain management will be achieved.

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