
The Order Fulfillment Process

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Order fulfillment is a key process in managing the supply chain. It is the customers' orders that put the supply chain in motion, and filling them efficiently and effectively is the first step in providing customer service. However, the order fulfillment process involves more than just filling orders. It is about designing a network and a process that permits a firm to meet customer requests while minimizing the total delivered cost. This is more than a logistics function, and it needs to be implemented cross-functionally and with the coordination of key suppliers and customers. In this paper the order fulfillment process is described in detail to show how it can be implemented within a company, and managed across firms in the supply chain. The activities of each sub-process are examined; the interfaces with functional silos, processes and firms are evaluated; and, examples of successful implementations are provided.

Order fulfillment involves generating, filling, delivering and servicing customer orders. In some cases, it is only through this process that the customer interacts with the firm, and therefore, the order fulfillment process can determine the customer's experience [1]. To accomplish these tasks, management must design a network and a fulfillment process that permits a firm to meet customer requests while minimizing the total delivered cost. This requires integration of logistics, marketing, finance, purchasing, research and development, and production within the firm, and coordination with key suppliers and customers. At the operational level, the order fulfillment process focuses on transactions, while at the strategic level, management can focus on making critical improvements to the process that influence the financial performance of the firm, its customers and its suppliers. For instance, order fulfillment directly affects product availability which influences total sales volume. An optimized network minimizes total delivered costs, including sourcing costs. A streamlined process reduces the order-to-cash cycle which frees up capital, and reduces the delivery lead-time which allows for reduced inventory levels. Thus, order fulfillment can affect the financial performance of the focal-firm, as well as other members of the supply chain.

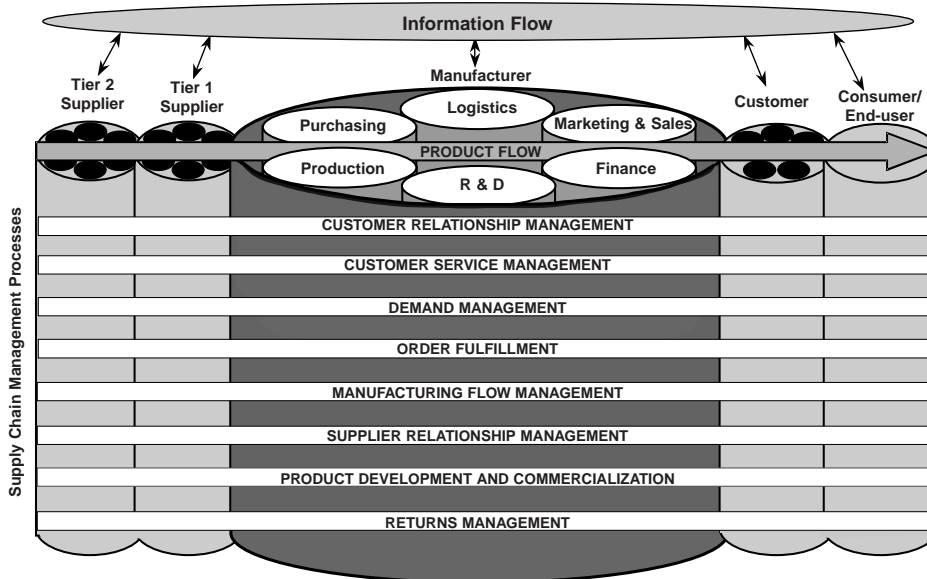
In this paper, the framework for implementing the order fulfillment process is developed. The process is described as it would be implemented at a firm in the middle of the supply chain, for instance a manufacturer or distributor. For a retailer, the process is similar in some respects, but it would need to be adapted before being implemented. Before describing the order fulfillment process, a background is provided on the eight supply chain management processes identified by The Global Supply Chain Forum, a group of leading global firms conducting research in supply chain management. This background is important because order fulfillment is one of the eight processes and it requires interfaces with the other seven. The strategic and operational processes that comprise order fulfillment are then described, including the sub-processes and their activities. In addition, the interfaces with the corporate functions, the other supply chain management processes and other firms are identified. Finally, opportunities for future research and conclusions are presented.

Background

Supply chain management has received substantial attention from both researchers and practitioners, yet in many companies management is struggling to implement supply chain processes

At the operational level, the order fulfillment process focuses on transactions, while at the strategic level, management can focus on making critical improvements to the process that influence the financial performance of the firm, its customers and its suppliers.

Figure 1
Supply Chain Management:
Integrating and Managing Business Processes Across the Supply Chain



Source: Adapted from Douglas M. Lambert, Martha C. Cooper, and Janus D. Pagh, "Supply Chain Management: Implementation Issues and Research Opportunities," *The International Journal of Logistics Management*, Vol. 9, No. 2 (1998), p. 2.

within their firms as well as 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].

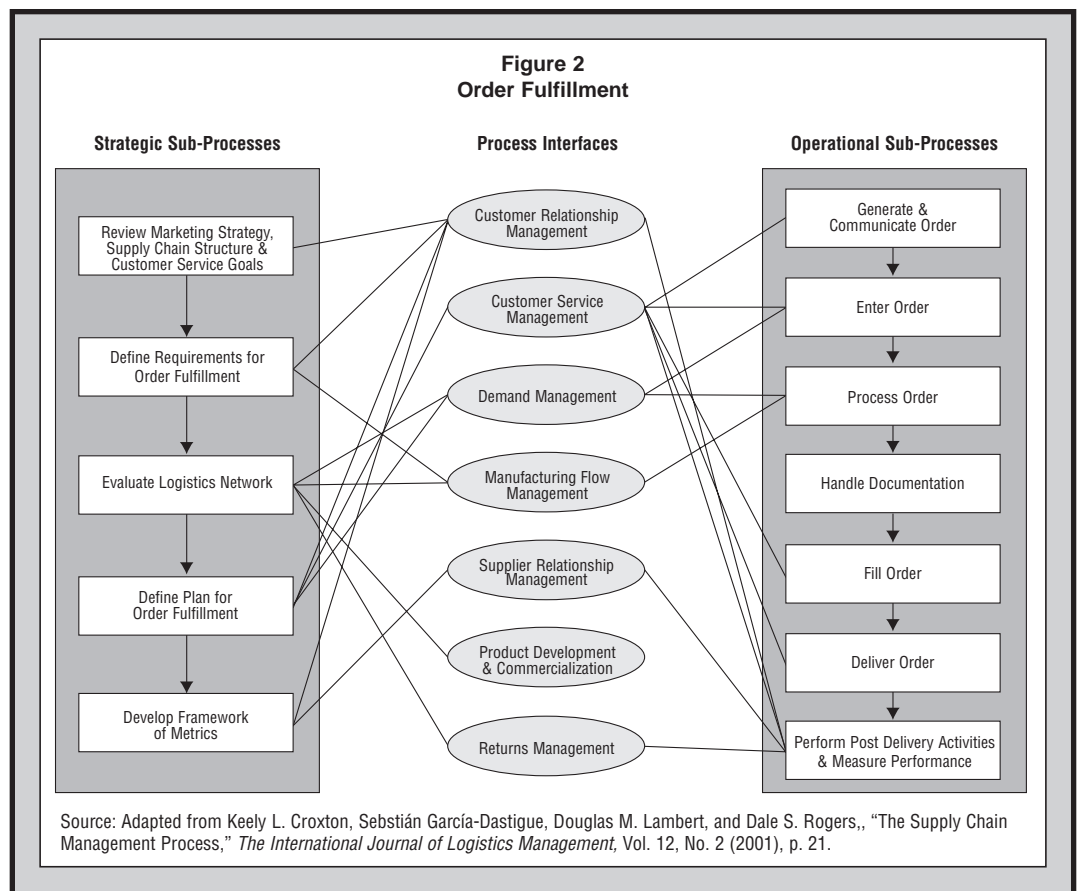
The Forum members identified the following eight key business processes that need to be implemented within and across firms in the supply chain (see Figure 1):

- Customer Relationship Management – provides the structure for how relationships with customers are developed and maintained, including the Product/Service Agreements (PSAs) between the firm and its customers.
- Customer Service Management – provides the firm's face to the customer, including management of the PSAs, and provides a

single source of customer information.

- 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 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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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 of the inter-firm activities are coordinated.

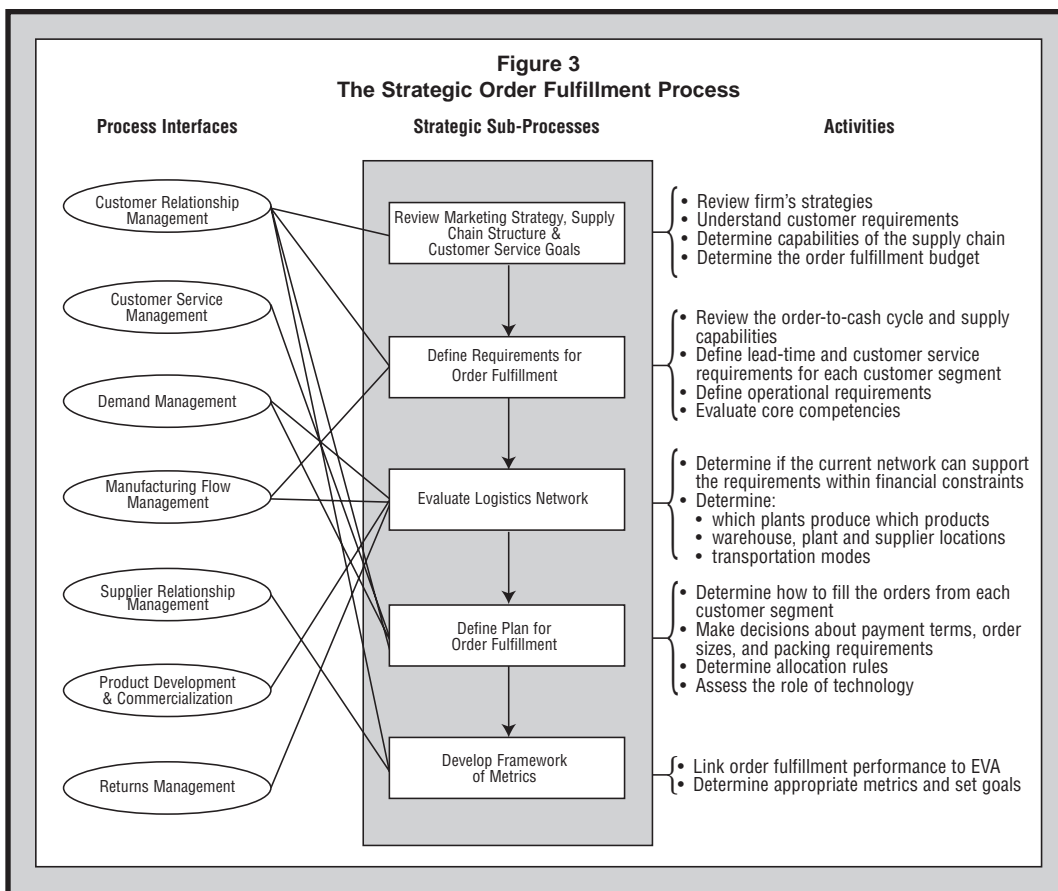
Croxton et. al. [3] further developed these eight processes by defining the sub-processes and activities that comprise each one. Figure 2 depicts the order fulfillment process based on that research. In this paper, the activities of each sub-process are examined, the interfaces between silos, processes and firms are identified; and, examples of successful implementation are provided. 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 five working sessions with members of The Global Supply Chain Forum over a period of two years.

The order fulfillment process has both strategic and operational elements, as shown in Figure 2. Therefore, the process has been divided into two parts, the strategic process in which management establishes the structure

for managing the process, and the operational process that is the execution of the process once it has been established. Implementation of the strategic process within the firm 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 take place. Figure 2 also shows the interfaces between each sub-process and the other seven supply chain processes. These interfaces might take the form of a transfer of some data that the other process requires, or might involve a sharing of information or ideas with another process team.

A cross-functional process team comprised of managers from several functions, including logistics, marketing, finance, purchasing and production, leads both the strategic and operational processes. The team might also include members from outside the firm. For example, the team might include representatives from a key customer 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

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managing the process at the operational level. Firm employees outside of the team might execute parts of the process, but the team still maintains managerial responsibility.

The Strategic Order Fulfillment Process

At the strategic level, the process team designs the operational order fulfillment process. This includes designing the network, establishing policies and procedures, and determining the role of technology in the process. This requires interfacing and communicating with multiple functional areas within the firm, and can be enhanced by working with suppliers and customers to develop a network and a process that meets the customers' requirements in a cost effective manner. Although many managers consider order fulfillment to fall within the role of the logistics function, it is the integration with other functions in the firm and other firms in the supply chain that becomes key in defining order fulfillment as a supply chain process. Figure 3 shows the sub-processes, activities

and interfaces for the strategic order fulfillment process.

Review Marketing Strategy, Supply Chain Structure and Customer Service Goals

In this first sub-process the process team reviews the marketing strategy, supply chain structure, and customer service goals to determine the order fulfillment capabilities of the firm and the supply chain. By examining the marketing strategy and customer service goals, they are seeking to understand the requirements of the customer and the role that customer service plays in the overall strategy of the firm. To fully understand the customers, the team should interface with the customer relationship management team to understand what is most important to the customer. Often this information is identified through a customer service audit [4]. Together, the two teams will determine which services are necessary to achieve and maintain corporate/supply chain goals.

The order fulfillment process needs to be designed around the customer, but within the limits of the firm's business and marketing

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strategy. The team also needs to understand the firm's order fulfillment budget. That is, determining how much is acceptable to spend on fulfilling the order. A firm might be able to most quickly deliver a product to the customer with an express air shipment, but the costs associated with that policy erodes profits and could be unacceptable. Likewise, financial issues might dictate a minimum order size or something about the selling terms. Throughout the design of the fulfillment process, the team needs to trade-off the costs of the solution with the benefits to the customer and the impact on the financial performance of the firm, and its customers and suppliers.

The supply chain structure is another important input into the design of the order fulfillment process. Both the sourcing and the distribution sub-networks that are in place impose limits on the cost and the lead-time of the fulfillment process. The team needs to examine the current network to understand its limitations and how cost is added as product moves through the supply chain.

Define Requirements for Order Fulfillment

Once the customer requirements and the limits imposed by the network structure are understood, the team can focus on defining the requirements for the order fulfillment process. This includes reviewing the order-to-cash cycle, understanding the supply capabilities, and defining the lead-time and customer service requirements. The customer relationship management and manufacturing flow processes provide input to accomplish this. In addition, the team needs to understand the operational requirements of the order fulfillment environment, including such details as how many orders need to be filled per day and how many dock-doors will be needed. There might also be legal requirements that need to be adhered to, for instance, handling requirements for hazardous materials, or customs requirements for international shipments. The process team should get a full understanding of all the requirements and make sure that the process is designed to adhere to them.

Customer differences might require management to develop an array of order fulfillment procedures. For instance, the customer relationship management team

might have identified key customers that need a shorter lead-time than others. In this case, the team would develop multiple sets of requirements and assure that the fulfillment process can meet all the variations. International Paper, the world's largest paper and forest products company, segments its customers into four categories, according to their sales and profitability. Within each segment, customer service profiles are defined. While these activities are part of the customer relationship management process, the order fulfillment team has to plan for those parts of the profile that pertain to order fulfillment such as order cut-off times and delivery times.

In addition, the team needs to evaluate the core competencies within order fulfillment and determine which aspects of the process are potentially service differentiating. For instance, Wendy's International, a quick service restaurant chain, has focused on its order delivery to drive-through customers, offering the fastest delivery among fast-food restaurants for the last four years [5]. If a firm offers guaranteed service levels, the order fulfillment team needs to consider how the process can be structured to accommodate these expectations. The team should determine what value-added services will be provided, to whom those services will be offered, who will pay for them, and their impact on the profitability of the firm and the supply chain. At Shell, a global energy company, the salesperson is responsible for the cost the firm incurs for the services offered to customers. Each salesperson then decides whether to pass these costs along to the customer.

Evaluate Logistics Network

After the first two sub-processes, the team knows the capabilities of the supply chain and the requirements of the customers. If the capabilities cannot support the requirements, the next step is to evaluate the supply chain network to determine if the network could be redesigned to resolve the gaps.

The design and operation of the network has a significant influence on the cost and performance of the system. One study showed that network modeling projects identify cost reductions of an average of 11.6% of controllable logistics costs [6], but

the structure of the network affects more than logistics costs. It can affect customer service levels, lead times and part component costs. Network design tools can be used to determine which plants will produce which products, where warehouses, plants, and suppliers should be located, and which transportation modes should be used. In addition, customers need to be efficiently assigned to networks of supply. These decisions affect the capabilities, the cost, and the timeframe of the order fulfillment process. In some cases, these decisions can have significant impact on other members of the supply chain. For example, Dowbrands, which at the time was the consumer products affiliate of Dow Chemical Company, found that they could reduce transit-time variability by designing the distribution system so that less-than-truckload shipments avoided break-bulk terminals [7]. This variability reduction allowed customers to hold less inventory. In a supply chain management environment, they could work with key customers to see if the increase in distribution cost would be offset by the reduction in inventory cost in the supply chain.

Historically, managers have focused their network design efforts on the internal portion of their supply chain [8]; that is, where the facilities they manage should be located. Increasingly, managers are broadening the scope of their network design projects to include a greater portion of the supply chain, such as first and second tier suppliers and customers [9].

These network models require data from every functional area within the firm. Obtaining accurate data often involves gathering data from upstream and downstream members of the supply chain. Particularly important input to this sub-process comes from the demand management, manufacturing flow, product development and commercialization, and returns management processes. Likewise, the resulting network has implications throughout the firm and the supply chain. The order fulfillment team is responsible for assuring that the new network is communicated and implemented appropriately.

Define Plan for Order Fulfillment

The next strategic sub-process defines

the plan for order fulfillment, determining how orders from various customers or segments of customers will be taken and filled. This is largely where the operational order fulfillment process is defined. The team also determines which portions of the process will be outsourced to a third party.

The team needs to make decisions about payment terms and allowable order sizes. These decisions require financial input and need to consider the impact of these factors on demand variability [10]. The team needs to consider customer requirements on picking and packing. Increasingly, customers are requesting customized packing; for instance, the size of the pallet, or the way the pallets are configured. The order fulfillment team needs to work with the customer relationship management team to determine the extent to which the process can be customized.

The effectiveness of the order fulfillment process can be strained by demand that is highly variable. During this step, the team should work with the demand management process team, as they are responsible for finding ways to reduce demand variability [11]. For instance, working with customers could lead to changing buying behavior, or working internally to change metrics could eliminate end-of-quarter loading. Smoothing out demand will make it easier to manage the operational order fulfillment process effectively.

An important consideration in designing the order fulfillment system is to determine what will be done when an order cannot be filled. The order fulfillment team needs to develop rules about how demand is allocated, or possibly when an order should not be accepted at all. At Colgate-Palmolive, a consumer packaged goods company, the team develops "Risk and Opportunity Grids" that provide operational guidelines about what to do in the case that demand cannot be met. For instance, which customers should receive priority, when to short a customer's order, etc? International Paper has rules in place that will only allow safety stock to be used to fill orders from its key customers. In another example, the management at Dell, a global computer manufacturer, takes a revenue management approach to order fulfillment [12]. They implemented a "sell what you have policy" where order-takers are encouraged to sell

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configurations that are readily available. They are given the flexibility to adjust the price on these available configurations to encourage customers to buy products that would be "easy" on the supply chain rather than ones that would incur extra costs and erode profitability [13]. For Dell, this has been an appropriate way to balance supply and demand through its order fulfillment process.

Before deciding to implement any allocation system, management needs to understand the customer service and customer satisfaction implications. The team should work with the customer relationship management team in developing these policies. Once the team determines the procedures, it is important to communicate them to the customer service management team, who addresses the concerns of the customers when these events occur. There is also a close interface with the demand management process at this point because these allocation rules need to be aligned with the contingency management system developed in the strategic demand management process [14].

An important component of designing an order fulfillment process is determining the flow of order information; in other words, how the order information will be captured and fed to the demand management process. For instance, manufacturing is outsourced at Lucent Technologies, a global communications network provider, so orders are sent directly to suppliers. At Moen Inc., a manufacturer of plumbing products, customers can place orders directly into Moen's SAP system, bypassing the traditional, and very manual, order entry process. At Taylor Made-adidas Golf Company, a manufacturer of golf equipment, sales people carry handheld computer units which allow them to enter orders from the customer site and download them into the Taylor Made-adidas order management system. In some supply chains, point-of-sale data are communicated between firms to allow suppliers to place orders with distributors. Each of these examples requires a unique information flow that needs to be developed by the order fulfillment process team. Because this usually involves data transfer between firms, which is increasingly accomplished with technology, the team

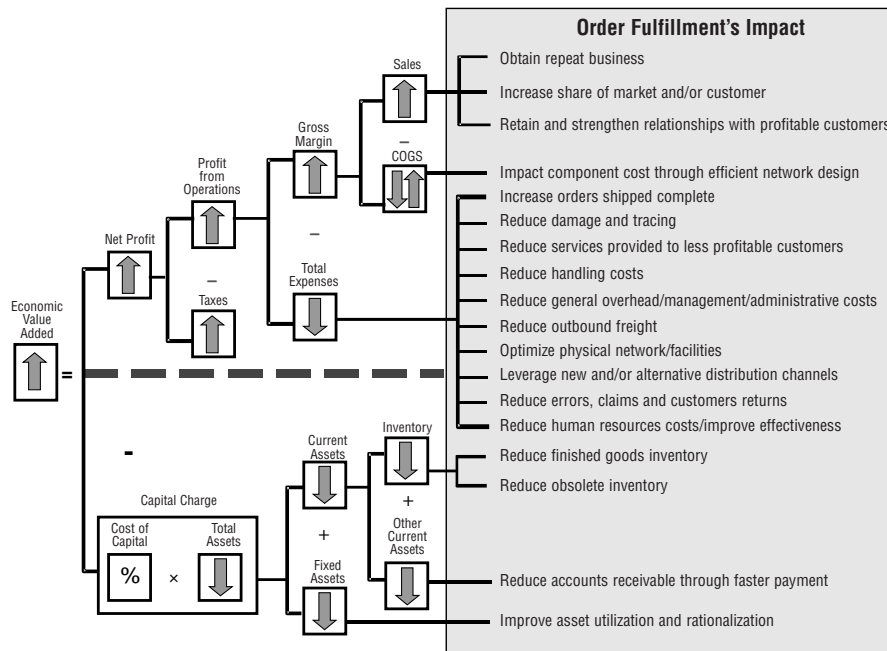
should consider the role of technology in order fulfillment and how it should be used to aid each step of the process and integrated with other members of the supply chain. Although decisions regarding technology need to be made at the strategic level, the technological options and issues will be explored in the section on the operational order fulfillment process, since the technology supports the operational activities.

Develop Framework of Metrics

In the final sub-process a framework of metrics must be developed to measure and monitor the performance of the process. As with all the supply chain management processes, metrics should be tied back to the firm's economic value added (EVA) [15]. Figure 4 shows how improvements in the order fulfillment process can affect the firm's EVA by influencing sales, cost of goods sold, total expenses, inventory investment, other current assets and fixed assets. A streamlined order fulfillment process can reduce expenses such as handling, freight and overhead. However, the execution of the order fulfillment process has less obvious implications. For example, improved product availability increases sales and market share. Efficient supply chain design can reduce component costs which can reduce the cost of goods sold, and reduce inventory levels throughout the supply chain. If the order-to-cash cycle is reduced, payments are made more quickly, which reduces the current assets on the books. The process team needs to understand these implications and understand how the process affects financial performance.

Once the team has an understanding of the impact that order fulfillment can have on the financial performance of the firm, metrics need to be developed for the activities performed. Typical process measures include order-to-cash cycle time, order fill rate, and order completeness. Many companies measure perfect orders, which usually incorporate the accuracy, the condition upon arrival, and the punctuality of orders. Some companies, like Hewlett-Packard, a global provider of technology products and services, track the number of order-touches to measure the efficiency of the order fulfillment process.

Figure 4
How Order Fulfillment Affects Economic Value Added (EVA)



Source: Adapted from Douglas M. Lambert and Terrance L. Polan, "Supply Chain Metrics," *The International Journal of Logistics Management*, Vol. 12, No. 1 (2001), p.13.

The team should work with the customer relationship management process team to make sure that they are not only aligning the order fulfillment metrics with the other metrics used throughout the firm, but that they are measuring what the customers deem important. It is important to assure that the firms in the supply chain implement processes that positively affect the EVA of the supply chain, not just an individual firm within it. It is the goal of supply chain management to drive behavior that benefits the entire supply chain while sharing the risks and rewards incurred. The team should share the framework of metrics with the customer relationship management and supplier relationship management processes and set goals for process improvement.

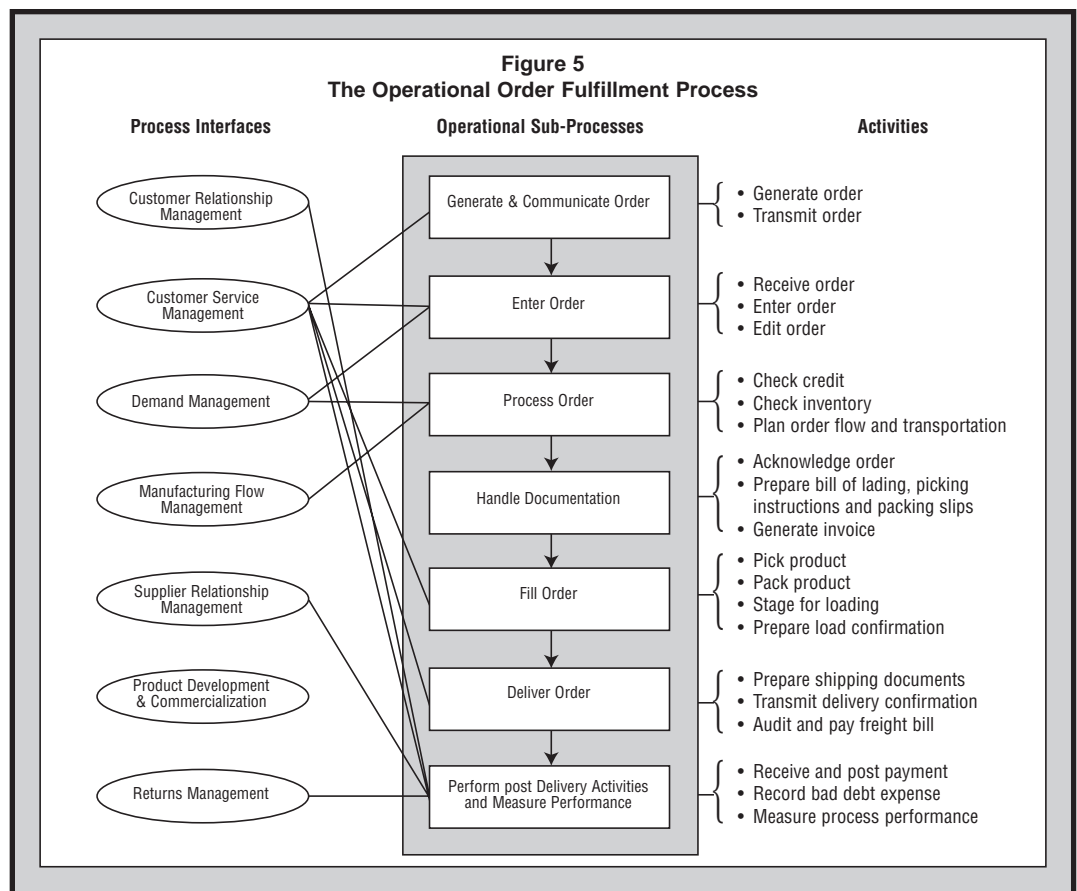
Developing the metrics is the last sub-process at the strategic level, but this does not mean that the work is done. The team should review the execution of the order fulfillment process periodically to assure that it is as effective and efficient as possible. Shapiro et. al. [16] recommend that management "staple themselves to an order" to look for horizontal

and vertical gaps in the process. This careful examination of the process once it is being executed at the operational level might lead the team back to the strategic sub-processes to re-design the network, the plan for order fulfillment, or the metrics.

The Operational Order Fulfillment Process

Figure 5 shows the seven sub-processes and activities that comprise the operational order fulfillment process. At the operational level, order fulfillment is very transactional. It is focused on managing the customer order cycle and the specific activities are executed primarily within the logistics function. In fact, a customer order is said to serve "as the communications message that sets the logistics process in motion" [17]. However, managers need to focus attention on managing the interfaces with the other supply chain management processes and with other functional areas within the firm, and finding opportunities to integrate with other members of the supply chain.

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Because order fulfillment begins with the customer's order, it is natural to integrate with key customers to streamline the order-to-cash cycle and make it as cost-effective for the supply chain as possible. The growth of technology in the supply chain environment has had significant impact on the order fulfillment process. Much of what used to be very manual steps has been automated by the advent and adoption of technology such as electronic data interchange (EDI), the Internet, available-to-promise (ATP) and capable-to-promise (CTP) systems, and enterprise resource planning (ERP) and advanced planning and scheduling (APS) systems. These technologies, along with others such as transportation management systems (TMS) and inventory visibility tools, can provide managers information that can be used throughout the supply chain to streamline the order fulfillment process.

The implementation of these technologies has had two significant effects on the order fulfillment process. One is the streamlining of the operational process which has taken days out of the order-to-cash cycle.

Ingram Macrotron Distribution, a subsidiary of Ingram Micro, implemented an electronic ordering system that reduced order processing costs by 60%, reduced order processing time by 30%, and decreased the average order fulfillment time by 60% [18]. In addition to the faster order fulfillment, it reduced the ordering costs of its customers by 12%, thereby providing benefit to other members of the supply chain.

The other effect that technology has had is on improving the ability for companies in the supply chain to integrate more effectively. Within order fulfillment, this integration usually takes place between the focal-firm and its customers. For instance, with the use of integrated technologies, the first two sub-processes can often be handled in one step. At Colgate-Palmolive, approximately 90% of orders are accepted through either EDI or the Internet and dropped directly into the SAP system for processing, where the order-flow and even transportation planning is automatically executed. This not only reduces steps in the process, but reduces order entry errors which can be costly and

time consuming to correct. Giving trace-and-track capabilities to customers is another way to integrate them into the process and reduce the workload on the customer service team. Streamlining the process improves customer service, allows inventory reductions, and improves cash flow. Implementing these technologies can be win-win for multiple members in the supply chain.

However, technology comes with a price, often not only for the focal firm but for other members of the supply chain. For instance, in the case of Colgate-Palmolive, the customers' technology needs to be integrated with Colgate-Palmolive's to streamline the transfer of data. It is paramount that management understands the financial impact of implementing these systems. Many companies faced failure after rushing into the e-commerce business because management believed that the internet would revolutionize order fulfillment. In determining which technologies to adopt, the order fulfillment team needs to weigh the costs against the value added by each technology. The technology should be judged by its ability to streamline the process and integrate the supply chain.

Generate and Communicate Order

As we trace an order through the operational order fulfillment process, the first step is to generate and communicate the order. Orders generally come through customer service, the sales organization, or directly from the customer. In some cases this is automated, for instance in an EDI or VMI environment, or other systems in which orders are automatically placed when the inventory level reaches a pre-set level. For other companies, the sales process is very labor intensive. Firms often lose valuable time in this sub-process and can reduce its duration by days using technology and automated information sharing.

The key functional interfaces for this sub-process are between the logistics, marketing and sales areas. At Herman Miller, a leading manufacturer of office furniture, management redesigned the sales process so that customers can lay-out a design for an office space on a salesperson's laptop. The customer can see how everything will fit and how colors will look together, and view it from any angle.

Once the customer has the design as they want it, the software creates an order list and provides a final price. The order can be easily downloaded over the Internet into the order system. This software application was designed primarily as a sales and marketing tool, but it also streamlined the order generation and order entry processes and reduced errors. Errors were reduced from more than 20% to near zero, and customers received order confirmation with shipping and installation dates within two hours of placing the order, as opposed to the old process where this would take over a week [19]. The integration of the sales process into the order fulfillment process yielded Herman Miller substantial benefits to their operational performance.

Enter Order

Once received, the order needs to be entered and edited, if necessary. Errors in receiving and entering an order can be very costly. The process team should measure and track error levels and look for root causes of the errors. Often, orders that are received do not contain all the required information. This might be due to an issue with the sales process or with the customers. For instance, it might be that orders are incomplete because the sales people are providing customers with incomplete quotes [20]. If this is the case, the process team should work with the sales force to improve order quotes and give customers complete information for their orders.

The team might work directly with customers to help streamline the process to reduce errors, perhaps by integrating technologies. Some companies have found that while giving customers the capability to enter orders directly into their system has streamlined the process, it has also increased the number of errors, perhaps because the customers are not as well trained as the firm's internal people. The process team should carefully monitor this and perhaps employ more checks and balances in the system.

Data regarding the orders are transmitted to the customer service management and demand management processes. The customer service management process needs to have data on order status to help customers. The demand management process

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uses the order entry information as input for generating future forecasts. Both process teams benefit if the information is received in a timely and error-free fashion.

Process Order

The first step to processing the order is to check the customer's credit. The credit check requires an interface with finance and is another common source of delay in the process. If orders are getting to this stage and not passing the credit check, the process team should work with the sales force to make sure they have information on which customers have credit problems. Also, a system should be put in place so that customers can easily determine how much credit they have available [21]. In some cases, systems can be designed so that this credit check occurs before orders are placed. For instance, if customers are placing orders over the internet, the system could prevent them from ordering if their credit situation is not good. New customers could establish credit on-line before being allowed to place orders.

Once the credit issue is resolved, inventory levels are checked and the order flow is planned. It is determined how the order will be routed through the supply chain which is commonly referred to as the distribution requirements planning (DRP) process. If the order will be filled from inventory, the inventory location is determined, inventory levels are updated, and the distribution plan is executed. If the order is composed of several products from different locations, the shipments will have to be coordinated [22]. For orders that are not filled directly from inventory, the DRP process will determine where the order will be manufactured or assembled and how it will be shipped to the customer by the due date. This information is important input for the demand management and manufacturing flow processes.

Handle Documentation

Once the order has been processed and planned, the documentation related to that order is prepared, including order acknowledgement, bill of lading, picking instructions, packing slips and the invoice. If the order will be shipped internationally, the

customs and duty forms will be prepared. Note that in some warehouse management systems (WMS), the documentation is prepared after the order is filled, reversing the order of this sub-process and the following one.

Many firms are providing customers with order visibility and tracking capabilities. In this case, part of the documentation is electronic in nature and needs to be updated throughout the remainder of the order fulfillment process.

Fill Order

The next stage of the order fulfillment process is filling the order. Usually, order filling occurs on the plant floor or in a warehouse and involves picking, packing, staging, and load configuration. The adoption of warehouse technologies, particularly bar code and wireless radio frequency technology, has improved the accuracy with which this step is executed. The team should also examine if the material handling and warehouse layout is efficient [23]. Once the order is filled and confirmed, the order status is communicated to the customer service management team so that they can provide information to the customer if requested.

It is important for the personnel who fill the orders to know if there are customer-specific specifications, such as particular packing requirements or pallet configurations. This information should be part of the picking instructions that were generated in the previous sub-process.

Deliver Order

The final step in the order-to-delivery process is to arrange delivery of the order. In this sub-process, shipping documents are prepared, the transportation plan is executed, delivery is confirmed, and the freight bill is audited and paid. In order to help the customer plan, advance shipping notices (ASN) should be sent.

Delays and errors in these steps can be costly, because there is little chance to make-up for the mistakes without impacting the customer. For most firms, it is also the point in the order fulfillment process where control of the order is relinquished, as it is usually handed over to a transportation company.

Effective relationships with transportation companies can play an important role in executing the delivery sub-process.

As part of the information flow, trace-and-track documentation is made available to the customer service team who will use this information when a customer inquires about an order. Alternatively, it might be sent directly to customers so that they can track their orders themselves.

Perform Post-Delivery Activities and Measure Performance

In the final steps of the order fulfillment process, payment is received and posted, discrepancies are addressed, and bad debt expense is recorded. The process of receiving and posting payment can often be labor intensive. If, for example, a customer sends in payment of an invoice but subtracts out deductions without explanation, the customer service management team needs to call the customer and follow-up on what the issues are and how they can be resolved. This becomes time-consuming for both parties. If firms can work with customers to minimize these types of issues, the total cost of delivery will be reduced.

An ongoing part of the order fulfillment process is to measure the process and communicate the results throughout the firm and to key members of the supply chain. Because the order fulfillment process has such direct impact on the customer, it is important to track the timeliness of the process. Two important metrics of the order fulfillment process are the order-to-cash cycle time and the customer cycle time. The order-to-cash cycle time measures the elapsed time from the receipt of the customer's order to the time that the proper payment is posted, while the customer cycle time is a measure of the elapsed time from the order being placed to the receipt of the order into the customer's inventory. It is important to examine not only the average duration of these cycles, but also the variability. The variability of the customer cycle time is particularly important to the customer, as they need to hold more safety stock when there is high variability. For the customer, reduction in the variability has more financial impact than a reduction in the average cycle time [24]. Measuring both the average and the variation in the time required

to complete each operational sub-process will allow the team to see where they should focus their attention.

Research Opportunities

This paper builds on previous work in which the eight supply chain processes were described by further developing the order fulfillment process, including a more in-depth explanation of the issues and activities involved in each sub-process. While this clarifies the process and starts to provide a roadmap for its implementation, there are several research opportunities that remain:

- Further examining the use of technology to streamline the process and integrate firms in the supply chain; that is developing a framework to help managers determine in which technologies to invest.
- 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 order fulfillment beyond the borders of the firm.
- Implementing the order fulfillment process across multiple firms in a supply chain, documenting implementation issues and how obstacles were overcome.

Conclusions

The order fulfillment process is often viewed as transactional and part of the logistics function within a firm. However, it is important that managers recognize its strategic components, its cross-functional needs, and its role within the management of the supply chain.

At the strategic level, the order fulfillment process involves understanding the internal and external requirements and assuring that the system has adequate capabilities. This includes understanding the business strategy and the customer service requirements, and designing a supply chain network to meet customers' needs efficiently. Another important component of the process is to have a responsive system in place for when demand exceeds supply and some orders cannot be filled. Assuring that this system still manages to meet at least the minimum needs of customers is critical to

An ongoing part of the order fulfillment process is to measure the process and communicate the results throughout the firm and to key members of the supply chain.

achieving good customer service even in the face of adversity. The other very important strategic piece comes in designing the metrics. There are numerous examples of bad metrics driving misguided behavior. The process team needs to examine the effects of order fulfillment on the financial performance of the firm and assure that the metrics used are consistent with improving the financial performance of the entire supply chain.

While the order fulfillment process is often viewed as a logistics activity, the process cannot be designed without input from other functional areas including marketing, finance, purchasing, and production, as well as support groups like information technology. Therefore, it is important that the process team be cross-functional. To achieve strong performance, the requirements of all functional areas must be met.

Although it is possible to implement many portions of the order fulfillment process without going outside the four walls of the firm, the real opportunities come when a firm reaches out to other members of the supply chain. Integrating key customers and suppliers can help streamline and improve the order fulfillment process. Whether it is through idea sharing or information sharing, the role of the other supply chain members takes the order fulfillment activities from a single-firm process to a supply chain management process.

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