SAP White Paper
Optimal Service Parts Management

INVENTORY PLANNING

BEST-IN-CLASS PROCESSES FROM CAT LOGISTICS

CONTENT

EXECUTIVE SUMMARY

INCREASE REVENUE IN THE SERVICE PARTS MARKET

Today's organizations – such as those in the aerospace and defense, automotive, agricultural, heavy equipment, high-tech, and industrial machinery industries – are pursuing the service parts and spare parts market for revenue and profit growth. At the same time, heightened customer demand and a dynamic marketplace require them to operate at unprecedented levels of flexibility and responsiveness in order to make the grade in this new market. They must efficiently address customer requirements and attain desirable profit margins.

Ultimately, to reduce costs and improve service effectiveness, contenders must shift from being reactive service parts organizations to proactive service providers. They must be prepared to address a range of issues related to service levels, inventory investment, transportation, fulfillment, and value-added services. By combining best-in-class processes and planning techniques supported by an appropriate IT infrastructure, organizations of all sizes can improve their efficiency and boost the success of their service parts management businesses.

As the second paper in a five-part series that describes the best-in-class processes of Cat Logistics Services Inc. (Cat Logistics), a wholly owned subsidiary of Caterpillar Inc., this paper focuses on inventory planning. Cat Logistics developed best-in-class processes applicable across a range of industries by leveraging its decades of experience managing large multitier networks and supporting the needs of global companies related to service parts logistics.

INTRODUCTION

SERVE DEMANDING CUSTOMERS IN A DYNAMIC MARKETPLACE

Organizations in the aerospace and defense, automotive, agricultural, heavy equipment, high-tech, and industrial machinery industries are pursuing the service parts and spare parts market for revenue and profit growth. This is a complex challenge for these companies, whose objective is to serve demanding customers in a dynamic marketplace. Although sales of service parts generate high margins and contribute significantly to profits, organizations must address and manage a number of issues to be successful, such as:

- **Service levels** – How long will a customer wait for a part before going to a competitor? What level of service will increase the likelihood of the customer coming back to place repeat orders for that product?
- **Inventory investment** – How much inventory is needed, and where should it be placed to satisfy service-level requirements? While this is a fairly straightforward decision for fast-moving parts, it is a challenging one for slow-moving parts, which make up the majority of parts serviced.
- **Transportation** – What are the various transportation modes available to meet customer requirements, and what are the associated schedule constraints and costs?
- **Fulfillment centers** – How many fulfillment centers are needed, and where should they be located?
- **Value-added services** – Which value-added services, in addition to the normal services provided, can the organization offer in order to differentiate itself from the competition?

The service parts environment is fraught with new challenges and complexity due to the growing number of low-volume items (see Figure 1). In the mid-1980s, market demand for new products and more frequent updates to those products resulted in tremendous growth in the number of active parts serviced. That growth continues today. Now organizations must manage a growing number of parts and warehouses to support an ever-increasing number of slow-moving, low-volume parts while maintaining high transaction volumes on fast-moving items.

Demands from customers for better service are dictating new approaches to service parts management that call for available inventory and fulfillment of committed delivery dates. This trend requires a new level of flexibility and responsiveness. Organizations need to make decisions more quickly, and the flow of work through the organization has to be efficient and accurately prioritized.

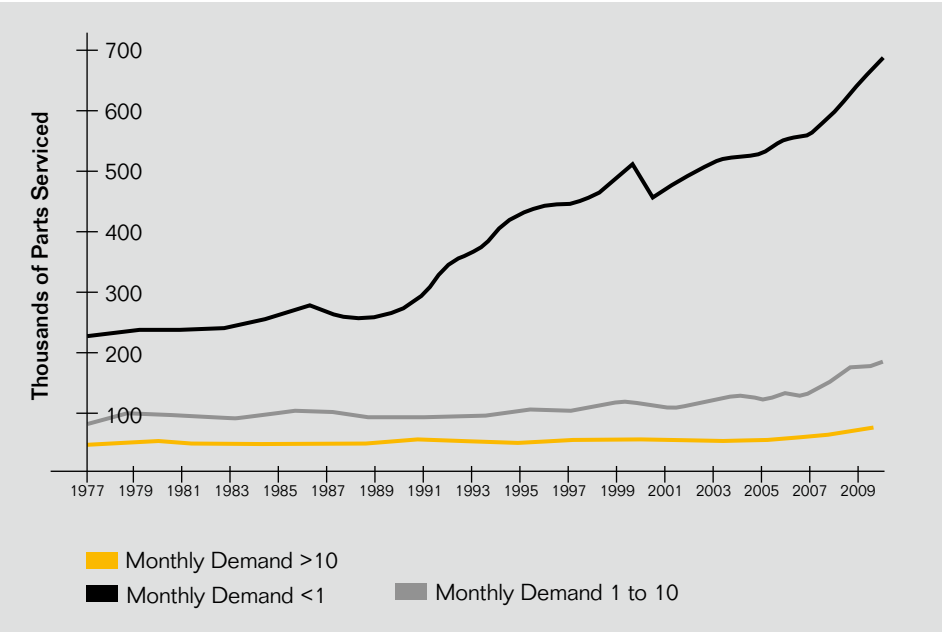

Figure 1: Growth in Slow-Moving Items at Cat Logistics Services

EXCELLENCE IN SUPPLY SHAREHOLDER VALUE

IMPROVE SUPPLY CHAIN MANAGEMENT PROCESSES RAPIDLY

In 1987 Cat Logistics was formed as a wholly owned subsidiary of Caterpillar Inc. in order to provide world-class logistics solutions to other companies. Today Cat Logistics serves more than 65 client companies, including Caterpillar Inc., in a number of market sectors worldwide.

Cat Logistics understands that shareholder value is directly linked to rapidly evolving process improvements in supply chain management that enhance customer service and help achieve higher revenue and margins while reducing costs. The company's culture revolves around a large-transaction volume, high-velocity business, a commitment to total customer satisfaction, and a continuous pursuit of process efficiencies. These considerations have driven the company to an integrated problem-solving approach that first identifies a problem, then analyzes the root cause, and finally implements a sustainable solution that improves the overall business. The progress Cat Logistics achieves is guided by an operating philosophy that drives results. Integral to this approach is a close connection to its dealers and a commitment to respond to customer demands as quickly as possible. A key factor is a highly integrated service parts planning and management solution, which helps Caterpillar attain success in its parts and service lines of business and ultimately realize additional sales of its equipment.

This paper is part two in a five-part series that describes the best-in-class processes Cat Logistics developed from its decades of experience managing large multitier networks. It also shares the know-how Cat Logistics gained over this period of time meeting the needs of global companies for service parts logistics in diverse product lines. The series is organized according to the operational processes illustrated in Figure 2. This paper focuses specifically on inventory planning.

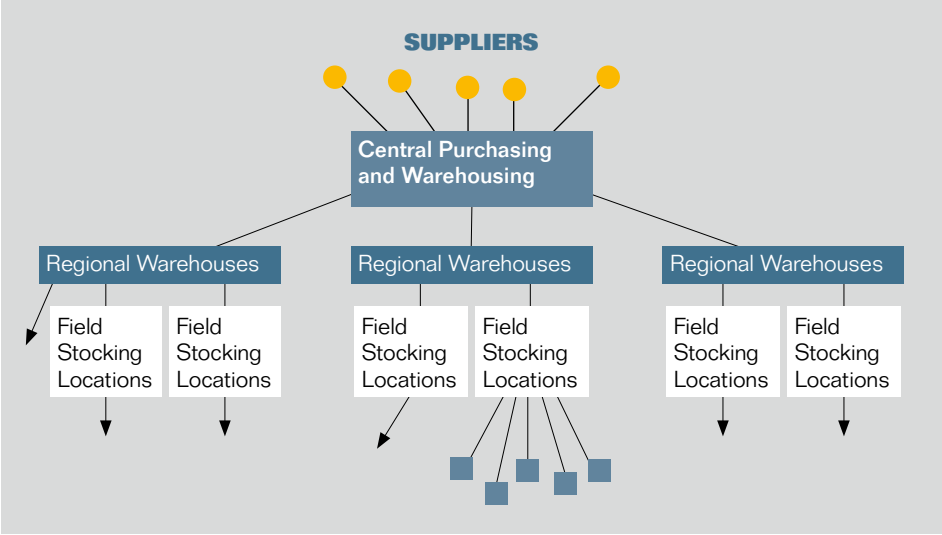

Figure 2: Key Processes in Effective Service Parts Planning and Management

INVENTORY PLANNING ACROSS THE NETWORK

MINIMIZE CASH TIE-UP IN INVENTORY

In today's competitive market, determining the appropriate quantities and types of inventory at each location is critical to delivering high-quality customer service and ensuring profitability.

Cat Logistics uses a bill of distribution network model in which "parent" facilities are responsible for replenishing "child" points. To calculate the optimal safety stocks in such a network, Cat Logistics makes forecasts and calculates associated forecast errors independently for each location in the network. This approach takes advantage of the "law of large numbers" by calculating the parent's forecast and associated forecast error over the aggregated demand of all its child points utilizing a fundamental of forecasting: the larger the aggregation of demand, the fewer forecast errors will occur.

This approach is especially important at the highest-level parent, where inventory comes in from the supplier (the entry point for bills of distribution), because the lead time from the supplier is typically the longest in the network. It ensures that the higher forecast errors at child points are not used inappropriately to calculate safety stock over supplier lead times.

So calculated, the network forecast can be proportioned to all child points to calculate a second child forecast and resulting forecast error. These forecast errors – one based on the child facility's independent forecast and the other based on the proportioned forecast – can then be evaluated. The forecast with the smallest forecast error is used for planning. Clearly, the child forecast with the smaller error is a better forecast, since it results in less safety stock. This approach is especially valuable when a seasonal pattern is seen at the network level but not detected because of low demand at a child location.

The combination of these techniques enables Cat Logistics to tie up less money in inventory and still provide high levels of customer service.

INVENTORY PLANNING

IMPROVE RESPONSE THROUGH PROACTIVE MAINTENANCE PROGRAMS

In today's competitive market, determining the appropriate quantities and types of inventory at each location is critical to delivering high-quality customer service and ensuring profitability. To properly plan inventory across a distribution network, organizations need to view all facilities and base plans on part volume and velocity.

While organizations need to position inventory where they have the highest probability of satisfying customers, they cannot afford to stock goods in every location. The key challenges organizations face are responding to global distribution patterns and dealing with inventory that has a variety of engineering attributes, use patterns, and cost patterns, while justifying their inventory investment to support their service-level goals. Although organizations will likely continue to expedite orders at higher transportation costs to ensure customer satisfaction, they can also improve responsiveness through better inventory management and proactive maintenance programs.

Determining Trade-Offs of Order Frequency and Safety Stock

Fundamentally, the forecast error leads to the safety-stock calculation, and safety stock is the key analytical criterion to consider when determining stocking levels. Cat Logistics also considers the lead time to receive the order; the order frequency, known as the economic order quantity (EOQ); and the desired service level.

Cat Logistics identifies the optimum trade-off between EOQ and safety stock by determining if there is a combination of EOQ and safety stock that provides the same quality of service but at a reduced inventory level. The practice generally results in a lower inventory level sufficient to achieve the desired quality of service. In one instance, Cat Logistics reduced its worldwide inventory by half a month of supply as a result of optimizing the relationship between EOQ and safety stock.

Cat Logistics' optimization of the EOQ and safety stock interrelationship is an example of how it innovatively applies known EOQ and safety-stock theories to further reduce safety-stock levels. For example, consider a six-month period with two different part numbers: one part is ordered once per month and the other is ordered once during the six-month period. For the item ordered six times, there are six opportunities for supply interruptions as well as six opportunities to impact availability because of demand increases. For the item ordered once, there is only one opportunity for a supply interruption. In addition, for most of the period, any demand increases could be absorbed by the extra pieces on hand for EOQ, allowing time to order additional inventory to cover the increased demand. Consequently, less safety stock is potentially required for the item ordered once in six months.

Resolving Optimal Inventory and Safety-Stock Planning

With five million SKUs and growing, the sheer volume of Cat Logistics' service parts inventory prohibits reliance on complex optimization processes for inventory planning. Instead of depending on the perfect inventory plan, which will likely be out-of-date tomorrow, Cat Logistics focuses on events that change inventory planning assumptions. While inventory planning continues on a regular basis, a more integrated solution enables the company to rely on this event-based execution strategy. This approach provides the flexibility to accommodate many different unplanned events.

Using rules-based, automated decision processes, Cat Logistics can determine the best response following changes in assumptions from the original plan. On some occasions this means immediately updating the inventory plan for

selected items. However, in most cases it requires altering decisions based on the existing inventory plan to accommodate a new situation. This approach requires the flexibility to manage service targets at several levels – individual part, part and location, or part grouping – so that the objectives account for practical factors, such as time fulfillment windows, competitive pressures, and inventory investment. The result is inventory that is where the customer expects it when it is needed. This event-based response strategy is especially critical in a service parts environment with a high volume of transactions.

Considering Dynamic Events That Affect Inventory Planning

Over the years Cat Logistics has evaluated inventory planning software by performing simulations to compare software performance with Cat Logistics' processes. The company found the evaluated software did not effectively consider dynamic events that impact inventory planning. Cat Logistics relies on dynamic strategies to establish planning factors for calculating safety stocks, determining EOQs, deciding when to stock (or not stock) a location, deciding what lead times to use, selecting the proper forecast methodology, and setting service targets. As a result, Cat Logistics found that planning software often recommended higher stocking levels, which increased transportation and warehouse handling costs and reduced service levels. When an organization is limited to a fixed set of parameters for optimization, as provided by most planning software, it is unable to take advantage of dynamic parameter settings, such as those used by Cat Logistics. These software solutions could not provide the results Cat Logistics required for the volume, speed, and global scale of its supply chain.

In addition to mathematical approaches, Cat Logistics employs practical approaches gained from years of experience optimizing inventory. Rather than rely solely on theoretical methodologies, Cat Logistics has developed processes based on parameter-driven, rules-based logic that result in near-optimal decisions with minimal human analysis or adjustments, which become impractical on a daily basis. Cat Logistics' rules-based approach employs planning fences, reasonability checks, and stability rules to ensure that changes are realistic and prevent system "nervousness" when borderline decision criteria are encountered.

For Cat Logistics, inventory optimization is a continuous and dynamic decision-making process that starts with the flexibility to configure multiple optimization strategies to meet its business objectives. Daily execution-related alerts and weekly and monthly analytics help Cat Logistics monitor both the supply and demand side of the equation. This continuous process enables Cat Logistics to sense and respond to changes more rapidly than if it set a theoretical optimization target at a single point in time. To increase or decrease its service levels, Cat Logistics simply resets its "dials" to achieve those results, and the process repeats itself.

Implementing Regional Inventory Planning Strategies

Rather than plan each low-volume facility individually, organizations can pool a number of low-volume facilities as a group under a "virtual network." This concept works particularly well when planning for valuable, low-volume, high-cost items for which it makes sense to send the order to the facility where the inventory is located rather than have inventory at all locations waiting for an order. This approach should be applied only to the portion of the network that makes geographical sense, especially from an international perspective. For instance, when performing consolidated ordering, it may be best to plan North American facilities as a consolidated, or virtual, group. It would not make sense to plan North American and European facilities as a consolidated group, because it is more difficult to share inventory across continents.

An organization may need to consider regional stocking strategies. An example is when demand on the U.S. west coast is enough to warrant stocking parts in the area but not high enough to warrant stocking any facility individually. Cat Logistics employs regional stocking concepts to pool demand in a region to see if the part should be stocked regionally. Based on various rules, a particular facility is chosen and stocked. Cat Logistics assigns all demand in the region to the stocked location to test if proper safety stocks and cycle inventory for the single stocked location are sufficient to deliver the desired service level to customers in the region. A key factor supporting this concept is the integrated systems approach that ensures that global available-to-promise functionality recognizes the inventory plan and directs orders to the stocked location in the region.

Another example of pooling is in planning regional safety stocks. In this case, to support a given level of service in a region, it's possible to plan the appropriate inventory for the area rather than trying to support service with higher safety stocks at all locations in the region.

All of these concepts are particularly valuable for dealing with expensive low-volume parts, and Cat Logistics uses them to contain costs associated with excessive inventory while efficiently meeting customer service requirements.

Calculating Seasonal Safety Stock

Cat Logistics has found it advantageous to calculate seasonal safety stock to ensure that the required extra stock is on hand for high seasonal demand. Such a safety-stock methodology enables organizations to stock lower levels during off-season periods. Applying the seasonal safety stock method for agricultural products has led to improved service levels and higher customer satisfaction during high-demand seasons. At the same time, seasonal safety-stock calculations enable organizations to account for different patterns of seasonality in a global network. For instance, a part might be considered seasonal at a different time of year in the United Kingdom than in Italy. For more information on seasonal safety stock, refer to "Forecasting Methodologies and Application" in *Optimal Service-Parts Management: Lessons from the Cat Logistics Services Inc. Best-in-Class Processes for Demand Planning,* the first paper in this series.

Monitoring Inventory Levels

Cat Logistics continually monitors inventory levels across the network and evaluates changes that cause inventory levels to rise or fall. The company is especially interested in establishing correlations between system improvements and lower inventory or better service to gain insight into how to achieve improvement. Cat Logistics monitors situations that call for special inventory planning, such as supporting a sales campaign or opening a new facility. Cat Logistics is able to track the buildup of inventory for special events and, as a result, has developed a better understanding as to why inventory might appear as excess if an event doesn't occur as planned.

If excess inventory cannot be used for the original purpose or is not expected to be sold quickly at that location, Cat Logistics can choose to redistribute inventory in the network where it can be used to fill customer orders. The decision to rebalance inventory is based on a number of factors, including the trade-off between how quickly the material can be sold at a new location and the costs to move it. Through monitoring, Cat Logistics quickly finds alternative uses for excess inventory before it becomes obsolete.

CONCLUSION

RUN EFFICIENT SERVICE PARTS PROCESSES TO SATISFY CUSTOMERS

The quality of service that organizations deliver can be a key competitive differentiator. The quality and timeliness of delivering that service depends on the availability of the parts needed to successfully conclude the service.

> For Cat Logistics, inventory optimization is a continuous and dynamic decision-making process.

To reduce costs and improve service effectiveness, organizations must shift from being reactive to being proactive service providers. By combining best-in-class processes and planning techniques supported by an appropriate IT infrastructure, organizations of all sizes can gain efficiencies and boost the success of their service parts management businesses.

Cat Logistics runs an efficient service parts business that keeps customers satisfied. Its success is due in part to its best-in-class business processes. These processes contribute to its efficient parts planning capabilities, reduced investment in service parts, higher order fill rates, increased service-related and service parts–related revenues, and greater customer satisfaction and loyalty.

To learn more about how the SAP® Service and Asset Management solution can help you improve your service parts management, call your SAP representative today or visit us on the Web at www.sap.com/solutions/sam.

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