

## **WAREHOUSING**

### BEST-IN-CLASS PROCESSES FROM CAT LOGISTICS



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# 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, industrial machinery, and other manufacturing 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, manufacturers 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 fourth 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 warehousing. 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.

To reduce costs and improve service effectiveness, manufacturers must shift from being reactive service parts organizations to proactive service providers.

# INTRODUCTION

## SERVE DEMANDING CUSTOMERS IN A DYNAMIC MARKETPLACE

Organizations in the aerospace and defense, automotive, agricultural, heavy equipment, high-tech, industrial machinery, and other manufacturing 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 transportation modes are 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?

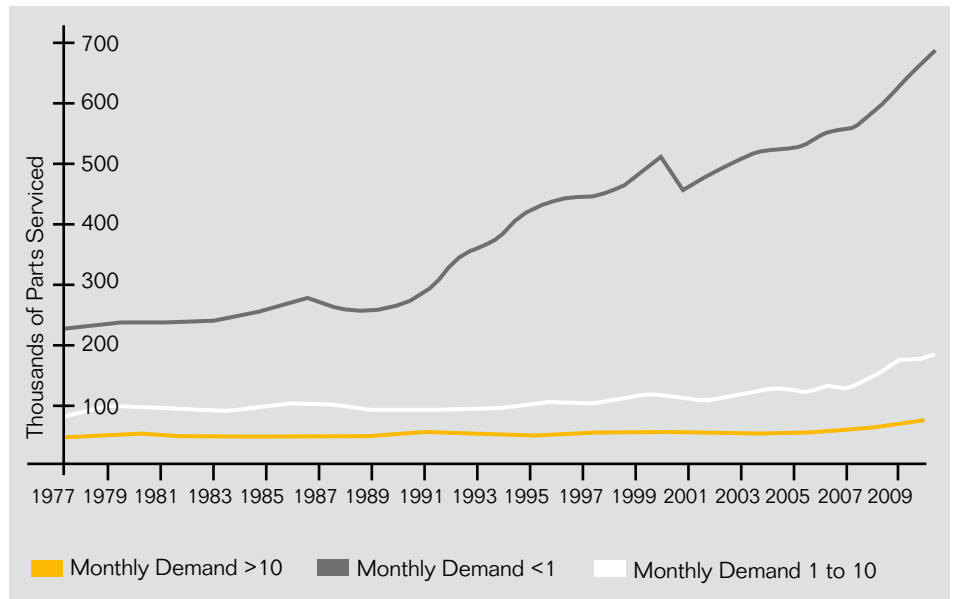


Figure 1: Growth in Low-Volume Items at Cat Logistics Services Inc.

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.

# 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 and 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 solu-

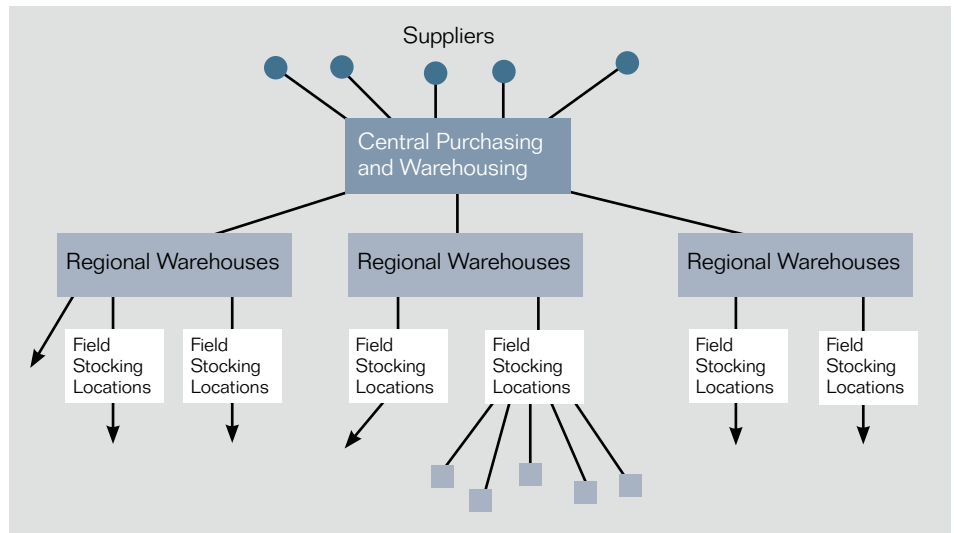


Figure 2: Key Processes in Effective Service Parts Planning and Management

tion, 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 four 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 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 warehousing.

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.

# WAREHOUSE ENVIRONMENTS

## STRIVE FOR EFFICIENCY AND INTEGRATION

The term warehouse usually conjures up the image of a vast storage space where products gather dust. Effective service parts operations, however, require efficient distribution and fulfillment hub operations that support the concept of product velocity and flow as well as superior customer service. As warehouse processes and related tasks become increasingly complex, manufacturers struggle to use existing warehouse resources efficiently.

A parts distribution center must be able to receive inbound shipments and quickly match cross-dock items to outbound logistics. Synchronized flow logistics enable manufacturers to design a warehouse for speed within the context of a global business, allowing high-volume parts to be moved quickly through the network to the point of demand. This flow also helps manufacturers to efficiently stock slow-moving parts so they do not become stranded assets but instead are strategically located to serve the demands of multiple customers. Ultimately, these measures reduce the need for warehousing space, resulting in significant cost savings. At the same time, manufacturers need to coordinate warehouse activities, equipment, and personnel with precision. One key step toward achieving such savings is to coordinate all warehouse work and worker movement to maximize efficiency.

### Warehouse Monitoring and Alerts for Visibility and Insight

To maximize productivity and ensure efficient operations, Cat Logistics monitors all personnel and equipment as

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well as inbound, outbound, and internal processes throughout the distribution supply chain. This includes oversight of the personnel who manage the processes, and the equipment needed to enable the processes.

Utilizing a warehouse monitor as part of a warehouse management system, Cat Logistics warehouse supervisors have visibility into which personnel and equipment are currently in use and can reassign underutilized personnel and equipment to the appropriate tasks. Likewise, visibility into all process steps enables Cat Logistics to make its operations as efficient and cost-effective as possible. For example, performance metrics might require that all the material on an inbound truck be unloaded, sorted, and put away within 12 hours. To help warehouse personnel meet these expectations, Cat Logistics' warehouse monitor provides the inbound supervisor with complete visibility into the number of items on an inbound truck along with the number of handling units that need to be unload-

ed, sorted, and put away. This insight enables supervisors to make decisions regarding the needed resources for each process step. It also allows them to prioritize which container to process first – before the truck even arrives at the warehouse.

The warehouse monitor provides the same type of visibility into outbound operations. From the time an order is entered by a customer to the time the customer's order is shipped and invoiced, Cat Logistics warehouse personnel have complete visibility into the process. They can see when the order is scheduled to be released to the warehouse, the picking area and packing station that need to be used, and the dock door from which it will be shipped.

In addition, the warehouse monitor provides insight into future workloads and enables inquiries into past performance. Warehouse personnel can see how much work was completed and how long it took to complete the pro-

cesses in the last hour, day, month, or several months. This data can be viewed at the warehouse level, the picking area level, and even the employee level. By measuring all these points through the warehouse monitor, Cat Logistics warehouse personnel are able to manage their processes in the most cost-effective and productive manner possible. If a certain part of the warehouse is not meeting standards, Cat Logistics can be alerted to investigate and determine the root cause. Example root causes might be a fundamental problem in the warehouse setup, an issue with a new process, or a need for improved employee training.

In these ways, the warehouse management system provides Cat Logistics with the tools it needs to efficiently and effectively fulfill requirements, meet internal metrics, and satisfy customer expectations.

### **Control of Inbound Tasks and Processes**

With visibility into the entire inbound process, warehouse operations personnel are better able to meet performance objectives. For example, by having visibility into the number and content of cases or handling units on each truck, Cat Logistics' warehouse management system can determine whether the material will require interim steps, such as spreading (distributing inventory on or near the receiving dock according to its destination bin to optimize the efficiency of the put-away process), or can move directly to a put-away location.

To maximize productivity and ensure efficient operations, Cat Logistics monitors all personnel and equipment as well as inbound, outbound, and internal processes throughout the distribution supply chain. This includes oversight of the personnel who manage the processes, and the equipment needed to enable the processes.

By controlling the processing of tasks and the sequence in which tasks are processed – in other words, by minimizing the number of times the product is handled within the warehouse – warehouse operations personnel can ensure optimal resource utilization. This, in turn, enables considerable cost reductions in the material flow process.

Cat Logistics achieves further optimization by integrating its planning, purchasing, order management, and warehouse management systems. This integration provides warehouse supervisors with real-time visibility into workloads, including the number of items on a truck, the total amount of work required to process the items, and the expected time remaining to complete the work. However, no matter how well a company plans, the unexpected happens, and Cat Logistics needs the ability to sense and respond to such events. All warehouse operations personnel must contend with variability. For instance, warehouse supervisors have no control over the volume on each truck. Cat Logistics

uses processes that help address variability and ensure as much standardization as possible. For example, a warehouse supervisor can specify parameters in the system so that employees can expect a consistent amount of work each time they begin their shift. By specifying that a certain number of items should be in a handling unit, warehouse supervisors can ensure that tasks are handled consistently and that employees are more efficient.

### **Verification Control and Exception Management**

Real-time visibility into the status of shipments facilitates proactive, exception-based alerting and resolution. By handling exceptions in a way that falls outside of standard processes, Cat Logistics warehouse operators can minimize variability during inbound and outbound processing. Companies can assign a dedicated person to handle exceptions and should use a system that supports exception management.

### Pick Exceptions

Because Cat Logistics' service parts management and warehouse management systems are tightly integrated, the company can automate many of the steps associated with pick exceptions. For example, if the order filler finds insufficient inventory in his or her bin to perform a pick, the system can block that bin from further picking, trigger an inventory count, and search the rest of the warehouse for additional stock. If the system locates additional stock in the same pick area, it can automatically insert the bin into the pick path of the original order filler. If the bin containing the needed inventory is located outside of the original order filler's pick area, the system can perform a wave determination for the new task and assign a different order filler to the pick. If the system cannot find the needed inventory in the warehouse, it can communicate the exception quantity back to the customer order management system. At that point, the global available-to-promise function can either place the item on back order or send the request to another facility to fulfill the order. This automation enables manufacturers to handle exceptions at the time and place of the exception to ultimately meet a customer's expected ship date, thus maintaining high customer service.

Manufacturers may find that the automated pick-exception process is best suited for experienced order fillers. In the case of less-experienced order fillers, manufacturers may choose to incorporate checks – such as reviewing the results of a pick – before dispatch-

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ing the order to the customer. Varying the techniques and automated follow-on processes according to the experience level of the order filler helps the manufacturer minimize the time spent processing exceptions. These steps also allow the manufacturer to verify the exceptions that require verification in order to minimize unnecessary costs for handling or transportation.

### Inbound Exceptions

Because Cat Logistics uses tightly integrated systems, its warehouse personnel are empowered to manage exceptions without the intervention of supervisors or exception clerks. The warehouse system keeps the distribution network apprised of circumstances such as inbound exceptions, which allows any other supply chain actions that must be performed as a result of the discrepancy to be initiated immediately. For example, if the discrepancy was an overshipment of a part on short supply, the service parts planning system can begin moving the part to the required location in the network right away. If the discrepancy is a shortage or a damaged product, the order fulfillment system is notified so that routing of future orders takes into account the actual salable

inventory on hand, and service parts planning is notified so that it can redeploy inventory as necessary.

### Integrity Checks

Cat Logistics uses technology to bring efficiency, accuracy, and visibility to warehouse processes. For instance, the use of radio frequency-enabled mobile technology, portable wireless printers, bar coding, and desktop terminal equipment with scanners provides real-time updates while employees perform their tasks.

When utilizing radio frequency-enabled mobile technology, integrity checks require Cat Logistics employees to validate that they are picking the correct part from the proper location and putting the part in the correct handling unit for its destination. The warehouse management system can recognize when the wrong part, handling unit, or bin location is scanned and will alert the employee with an error message. This type of verification helps reduce errors, ensure accurate customer shipments, and lower customer claims, which in turn help reduce warehouse costs and deliver a high level of customer service.

## Wave Management for Control of Workflow

Wave management provides Cat Logistics warehouse operations with a flexible framework to predefine the amount and type of work released to the warehouse. Personnel can make these determinations based on planned execution times as well as planned shipping dates and times. The waves can be automatically designed based on a variety of parameters to support the warehouse execution plans. For instance, waves can be limited to groups of customers, areas of the warehouse, order types, type of material, number of order lines, or total wave size (by weights or volume, for example).

Warehouse supervisors can also specify whether a wave should automatically release at a predetermined time or whether someone needs to manually release the work to the warehouse floor. For example, warehouse personnel might need extra time to pick and transport large parts located in the area of the warehouse furthest from the shipping dock door. The supervisor could specify that a predefined wave for that warehouse area will release a few hours before the rest of the order line items. The warehouse supervisor can choose the precise time a wave of work should start, so that warehouse resources can be focused on the highest-priority tasks at that point in time. The integrated service parts solution used by Cat Logistics provides insight into when work will reach the warehouse floor, enabling the supervisor to react to exceptional situations. For instance, the warehouse supervisor

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can release a wave early to accommodate an area that is ahead of schedule or can release specific customer orders early to expedite them through the warehouse.

### Warehouse Order Creation

Cat Logistics' warehouse order creation process is an automated practice using rules and algorithms that produce optimized units of work for warehouse employees. Some of the parameters the warehouse can use in creating these rules include:

- Minimum and maximum weight and volume for a warehouse order
- Number of order lines
- Number of different customers
- Number of containers – pallets, boxes, or cartons – that can be picked and transported at the same time
- Maximum weight and volume of an individual container
- Types of materials to combine in an order

By consistently applying these parameters, the process removes variability and helps supervisors and employees understand the expected amount of time to pick a single warehouse order. As additional waves are released to the warehouse floor, the warehouse management system continually reprioritizes orders not yet completed based on the promised completion date and times. This enables warehouse workers to complete subsequent tasks and processes to meet the promised ship date and time.

Part of the warehouse order creation process involves putting the individual pick tags of the warehouse order in a predefined optimal pick path. This pick path is designed to take into consideration the optimal traffic patterns and physical restrictions of a warehouse's equipment and facility. Flexibility in the determination of the pick path based on different techniques used in different picking areas enables the ware-

house to utilize the most efficient method based on the circumstances.

As mentioned earlier, with the use of radio frequency-enabled technology, if an employee tries to pick a part from a bin and finds an insufficient quantity, the person can enter the exception into his or her mobile device. The warehouse management system will then resequence the remaining lines of the warehouse order within the pick path. This allows the employee to pick the part from a different bin within the current warehouse order later in the pick path.

Even the Cat Logistics warehouses that do not use radio frequency-enabled technology place bar-code printers, wireless scanners, and terminals throughout the facility, enabling warehouse workers to continually interact with the warehouse management system. For instance, employees can report warehouse orders being completed, items being packed into a container, and containers being loaded onto trucks. By having warehouse employees update the system as work is performed, supervisors gain insight into work completed and, more important, into work that still needs to be done. This visibility allows supervisors to deploy resources efficiently.

### Optimized Utilization of Warehouse Space

To reduce costs and improve throughput, manufacturers must ensure efficient warehouse space utilization. For any given part, the following part and bin attributes, as well as the warehouse

physical layout, must be considered in order to determine the correct-size storage bin or opening in the appropriate location of the warehouse:

- Part weight
- Part dimensions
- Part packaging
- Bin dimensions
- Number of pieces that can fit into a particular bin opening
- Maximum weight allowed in the bin
- Options for situating the part in the bin
- Part orientation
- Part demand

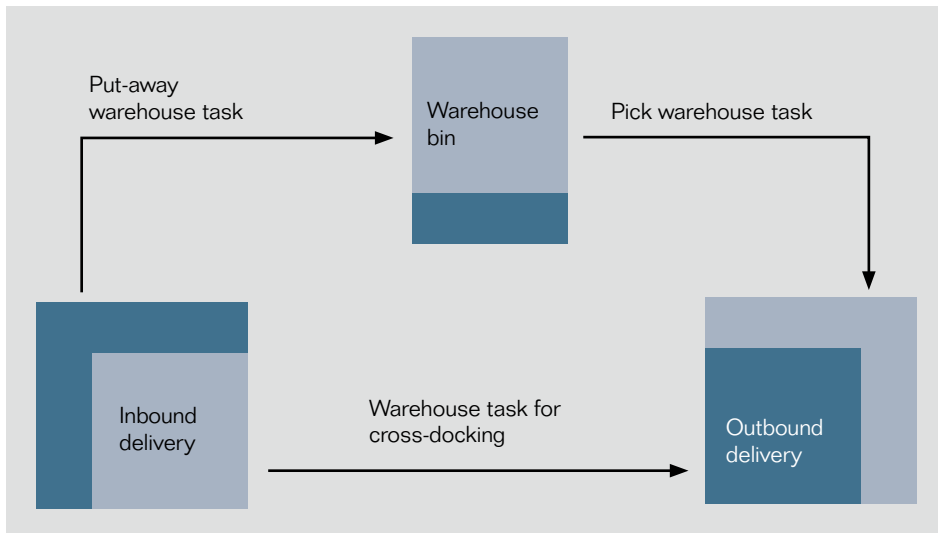
The forecast can help determine the appropriate bin opening based on the expected velocity. For instance, perhaps a fast-moving part should be located between knee and shoulder height for easy picking while a slower-moving part should be at a higher elevation. Or perhaps faster-moving large parts should be stored as close to the optimal pick path as possible. Product type can also influence part placement. For example, warehouse employees do not want to store heavy items and fragile parts in the same pick path. If the warehouse includes a special storage area for confining hazardous materials or fluids, the warehouse management system must also take that into consideration.

By efficiently utilizing its algorithms, Cat Logistics can increase the part density in a given amount of space and increase the operational efficiency of the movements through that space. In other words, it can fit more material in a smaller warehouse, thus reducing capital expenses, while simultaneously

lowering operating costs associated with inbound and outbound movements.

### Cross-Docking and Push-Pull Deployment

To ensure that the warehouse functions as a logistics flow hub or merge-in-transit point, Cat Logistics relies on push-pull deployment to be executed by warehouse operations personnel. Cat Logistics' push deployments are always cross-docked, and the company relies on cross-docking routines that can be planned ahead of time. These routines, also known as event-driven cross-docking, optimize the transportation network and control warehouse activities. Event-driven cross-docking supports the philosophy of achieving maximum product velocity to the demand location and helps Cat Logistics fulfill orders before items are placed in a bin. Ultimately, this helps minimize the number of inventory touches. By supporting both planned and opportunistic cross-docking, manufacturers can speed up the flow of goods through warehouse facilities and in turn reduce cycle times.



**Figure 3: Event-Driven Cross-Docking to Help Control Warehouse Activities**

For instance, a warehouse might receive a customer back order or workers may need to redeploy inventory within the distribution network. When inventory is received, warehouse personnel can be directed to cross-dock the inventory directly from the inbound to the outbound dock, eliminating the time and space necessary to store the product before redistributing it. In case a partial quantity is required for the cross-dock, the operator can be directed to deconsolidate (or “spread”) the stock between the back order, the push deployment, and the put-away stock.

Equally important, Cat Logistics can reduce its transportation costs by leveraging its distribution network. For instance, orders can be sourced to a

warehouse where they are picked and packed for the customer. The parts for the order are then shipped to a second warehouse where they are moved directly from the receiving dock to the shipping dock to be grouped with the remaining parts for the order or additional orders for that customer. One example of a situation that would utilize this process is inventory pooling, often used for slow-moving parts. With inventory pooling, the stock can be consolidated into fewer locations, and when requirements for those parts arise, they can be picked, packed, and distributed to the facing locations. Then they are cross-docked to the customer, minimizing the inventory requirements for the stock while at the same time lowering transportation costs associated with redeploying the limited stock. Tight

integration between the service parts planning and warehouse management systems is critical to facilitating this cost-minimizing technique.

### Product Velocity Monitoring

While Cat Logistics' warehousing system monitors activities and events in the warehouse, the integrated service parts planning system delivers additional insight. By constantly monitoring product velocity and parameter-driven stocking decisions, Cat Logistics can avoid excess stock, stranded assets, or material obsolescence. Cat Logistics relies upon the service parts planning system to respond to changing product velocity and to continually reclassify items as fast, medium, or slow movers. Where applicable, the warehouse management system can then utilize this information to reassign the product to a more optimal bin location in order to maximize productivity and material velocity.

If sales forecasts drop dramatically for material in a satellite facility, Cat Logistics may choose to redeploy that inventory to a parent facility or to a different warehouse in order to free up space. Effectively implementing this approach requires a strong partnership between service parts planning and the warehouse.

## Value-Added Services

To remain competitive, manufacturers can develop warehouse operations and activities that provide additional revenue opportunities, such as customer-specific packaging, product preservation, price marking, tagging, kitting, and just-in-time labeling. First, manufacturers need to determine if they can provide value-added services efficiently enough to make it worthwhile. By offering standard value-added services to multiple customers, manufacturers are more likely to succeed than if they offer different services to a variety of customers. To facilitate this, Cat Logistics' warehouse management system can set up different workstations that align warehouse processes and unique services so that warehouse supervisors have the ability to execute these value-added services efficiently.

## Management and Optimization of Warehouse Processes

Cat Logistics' warehouse management system can support a host of other warehouse processes that are important to service parts organizations. For example, various kitting techniques – including kit-to-order and kit-to-stock – are supported within the warehousing application and are directly integrated into the sales and production systems. Integrated support for production supply, claims and returns, and managing exceptions for stock transport orders is embedded within the application as

well. Cat Logistics' warehouse management system supports internal warehouse processes such as interleaving, labor management, and execution constraints, for example, managing the number of workers that are permitted to work in a physical area at one time. Managing these processes increases efficiency and workforce effectiveness, which in turn leads to better customer service at a more competitive cost.

# 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. 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 and supporting them with an appropriate IT infrastructure, organizations of all sizes can gain efficiencies and boost the success of their service parts management businesses.

Cat Logistics deals with a tremendous amount of slow-moving but high-volume parts. By sequencing all warehouse work and worker movement, Cat Logistics is able to run 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 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](http://www.sap.com/solutions/sam).

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