

The following is an excerpt from Scott Hamilton's book

# Managing Lean Manufacturing Using Microsoft Dynamics AX 2009

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*Provided Courtesy of Scott Hamilton, Ph.D.*

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## Summarizing the Transition to Lean

An integrated supply chain management (SCM) system represents a critical success factor for effective implementation of lean manufacturing. The SCM system must be able to manage variations in lean scenarios as well as changes associated with continuous improvement efforts and the maturity stages of lean manufacturing. This chapter summarizes the book contents and the transition to supply chain management for lean manufacturing. The chapter consists of the following sections:

- ❖ Managing the Variations in Lean Scenarios
- ❖ S&OP Approaches for Lean Scenarios
- ❖ Applicability of Traditional SCM Approaches
- ❖ Managing Components with Traditional Supply Orders
- ❖ Sales Order Delivery Promises
- ❖ Managing the Maturity Stages of Lean Manufacturing
- ❖ Initial Cutover for Using Kanbans
- ❖ Managing Continuous Improvement and Engineering Changes
- ❖ Alternative Approaches for the Lean Scenarios
- ❖ Concluding Remarks

### Managing the Variations in Lean Scenarios

Variations in lean scenarios can be broadly categorized into make-to-stock and make-to-order products. A given work cell typically produces a family of products that represent make-to-stock or make-to-order products, or both. These two variations employ fixed kanbans and PTO kanbans for supply chain coordination of purchased items, manufactured items, and transfers of stocked items. Each type of kanban differs in terms of the policies for creating a kanban, the life cycle of a kanban, and the relevant coordination tools.

In many make-to-stock scenarios, the end items are stocked at the final assembly work cell and pulled to a shipping area (via PTO replenishment kanbans) based on actual sales orders. In many make-to-order scenarios, the products consist of stocked components which can be managed via fixed kanbans. In both cases, traditional supply orders may be used for stocked components, such as using purchase orders when suppliers are not prepared to handle kanban coordination approaches.

A work cell often reflects internal manufacturing, and has an associated floor stock area for components and even completed items. A work cell can also reflect subcontract manufacturing, where the supplied components can be sent as a discrete kit to the subcontractor (with the manufacturing kanban) or stocked as consigned inventory at the subcontractor.

### **S&OP Approaches for Lean Scenarios**

The S&OP game plan differs for make-to-stock and make-to-order products. With make-to-stock products, the S&OP game plan is expressed as a set of fixed kanbans for every item in the product structures, where the kanban levels reflect the anticipated rate of demand. This demand plan represents a key aspect of the S&OP approach. The demand plan for fixed kanbans can reflect three options: sales forecasts, the pipeline of actual sales orders, or both. The planning calculations use the demand plan to suggest planned orders that “chase the demand,” and planned orders provide the foundation for calculating kanban levels for fixed kanbans. These calculations—termed the *Recalculate Kanban Level* task—are performed using the planned orders within a specified set of master plan data. The suggested kanban levels can then be used to manually increase or decrease the number of fixed kanbans for each item.

With completely make-to-order products, the S&OP game plan is expressed as a set of PTO kanbans linked to sales orders for end items. The sales orders for end items constitute the demand plan. Each sales order line item has a corresponding PTO manufacturing kanban that represents the supply. Releasing a PTO manufacturing kanban for the end item triggers the generation of PTO kanbans for its pull-to-order components. Hence, the release step provides visibility of requirements across the product structure.

Make-to-order products may also be built from stocked components. The stocked components can be obtained via fixed kanbans or traditional supply orders.

### **Applicability of Traditional SCM Approaches**

Some lean manufacturing scenarios can be supported by the traditional SCM approaches within AX. Make-to-order products linked to sales orders, for

example, can employ the traditional AX approaches to closely mimic PTO manufacturing kanbans using production orders for the end item and reference orders for its make-to-order components. This was illustrated in Case 1. In contrast, the traditional AX approaches for handling make-to-stock products (or make-to-order products indirectly linked to sales demand) cannot easily mimic fixed kanbans. For example, the near-term planned orders loosely mimic fixed kanbans, but they do not provide the detailed day-to-day coordination between supplies and demands in a multilevel product structure. However, the traditional approach to an S&OP game plan for make-to-stock products can still be used to calculate the number of fixed kanbans. The same S&OP game plan can also be used to generate planned orders for components not yet managed by kanban coordination.

### **Managing Components with Traditional Supply Orders**

Many manufacturers with lean scenarios will purchase material without using kanbans because the suppliers are not yet ready for lean approaches. In this case, the traditional approaches for using planned purchase orders and the related coordination tools will coordinate purchasing activities. The purchased material can be delivered to a stockroom, and then consumed by fixed replenishment kanbans for moving material to a floor stock area. Alternatively, the purchased material can be consumed as a result of component backflushing triggered by receipts of manufacturing kanbans.

A lean scenario may also involve other types of supply orders for stocked components, such as production orders or transfer orders. In this case, the traditional approach for using planned production orders, planned transfer orders, and the related coordination tools will coordinate supply chain activities.

The same S&OP game plan used to calculate fixed kanban levels can also be used to generate planned orders and coordinate replenishment of these non-lean items. Information about planned orders can be filtered to view just the non-lean items. You can firm up the planned orders for non-lean items. You cannot firm up the planned orders for kanban-controlled items, since they are already being managed by kanban orders.

### **Sales Order Delivery Promises**

Sales order delivery promises align the actual demands within the constraints of material and capacity availability. A promised delivery date can be automatically calculated based on capable-to-promise (CTP) logic or the work cell's drumbeat or both. With CTP logic, the calculations consider the availability of on-hand inventory and each item's lead time. The delivery

promises based on a work cell drumbeat require the use of a lean order schedule for the work cell and only apply to make-to-order products with PTO manufacturing kanban policies. An alternative approach to a work cell's drumbeat was described as a case study.

## Managing the Maturity Stages of Lean Manufacturing

Most companies begin their lean journey with a pilot project approach, which represents the first of three maturity stages in lean manufacturing. The first stage generally employs order-based costing, and a floor stock management approach that provides detailed tracking of component inventory in floor stock areas. Detailed tracking involves backflushing of component quantities to correctly support order-based costing. An alternative approach entails backflushing of component value based on the cost substitution concept. This alternative approach requires an explicit kanban empty transaction for floor stock components, since the component quantities are not being backflushed.

With the second and third stages, the biggest change involves value stream costing, and the associated elimination of floor stock inventory tracking. A financial dimension provides the basis for value stream costing that reflects a product family and/or the internal work cells that constitute the value stream. Black hole warehouses eliminate inventory tracking through the production process, but still support the use of pull signals (via empty kanbans) to coordinate supply chain activities.

These three maturity stages are reflected in variations of using the lean manufacturing functionality within Dynamics AX. For example, the software supports the transition from traditional approaches to lean, the transition from order-based costing to value stream costing, and the transition from detailed tracking to no tracking of floor stock inventory.

## Initial Cutover for Using Kanbans

The initial cutover suggestions differ slightly for fixed and PTO kanbans. With fixed kanbans, you can use the inactive status when defining the kanban policies and creating the kanbans for each item and warehouse. An inactive status means that the kanbans will not appear on the coordination tools. As another intended purpose, you can continue using traditional approaches (such as purchase orders and production orders) prior to cutover. The status should be changed to active at the time of cutover.

With PTO kanbans, you can also use the inactive status when defining the kanban policies for each item and warehouse. This means that a sales order for the end item will not generate a PTO manufacturing kanban. You can

continue to use traditional approaches for creating a corresponding production order for the sales order end item, and releasing this production order to create reference orders for make-to-order and buy-to-order components. The status should be changed to active at the time of cutover, which means a sales order will automatically create PTO manufacturing kanbans for the end item.

Some limitations may apply to new items or obsolete items, such as limiting the ability to purchase or produce an item. Two item-related policies will limit kanban transactions: a stopped flag for purchases and a stopped flag for inventory transactions. The item's stopped flag for purchases will prevent creation of a blanket purchase order, and prevent reporting of kanban receipts. The stopped flag for inventory transactions will prevent reporting of any kanban receipts and consumption.

### **Managing Continuous Improvement and Engineering Changes**

Ongoing changes are often driven by a philosophy of continuous improvement, such as changes to purchasing and manufacturing practices, changes to bills of material, or changes to factory layout. Each change requires slightly different considerations.

Suggestions were provided for managing changes to fixed kanbans. Some changes must be implemented by deleting the existing kanbans and then creating new kanbans. These include changes to the normal kanban quantity, item origin, and the preferred work cell or BOM version for a manufacturing kanban. Changes to the BOM component information typically require a change to the kanbans associated with the components. For example, these changes may impact a component's quantity or warehouse source, or reflect additional components in a bill of material.

Suggestions were also made for managing changes to manufacturing kanbans with subcontracting. The changes include the use of a different subcontractor and subcontracting on a one-time or intermittent basis. Some changes must be implemented by deleting the existing kanbans and then creating new kanbans. These include changing the outside operation component and changing the subcontract kanban type (discrete kit versus consigned inventory).

### **Alternative Approaches for the Lean Scenarios**

A baseline model of operations was used to simplify explanations throughout the book. It excluded several variations of manufacturing practices such as the use of bin locations within a warehouse, batch tracking, quality orders,

and multisite operations. A separate chapter described the approaches for handling these variations. It also covered alternative approaches to fixed kanbans.

Target kanbans represent an alternative approach to fixed kanbans. The same coordination tools apply to both. The two critical differences involve the automatic creation of target kanbans based on min/max logic and on-hand inventory balances, and the automatic deletion of target kanbans after receipt. The min/max logic is expressed as a target quantity (the maximum) and a trigger quantity (the minimum). A phased target kanban represents a slight variation to a target kanban, since it can achieve a total target quantity in phases. It is commonly used to ramp up (or ramp down) the number of target kanbans.

### **Concluding Remarks**

This book covered the software functionality to support lean manufacturing scenarios, as defined by functionality within the latest release of Microsoft Dynamics AX 2009. It also covered the traditional approaches to these same scenarios, as defined in a previous book, *Managing Your Supply Chain Using Microsoft AX 2009*. The book explained the incremental conceptual differences between the lean and traditional approaches. The intended objective is to help people transition from traditional to lean approaches for supply chain management of lean manufacturing.