10 Steps to become a Lean Enterprise

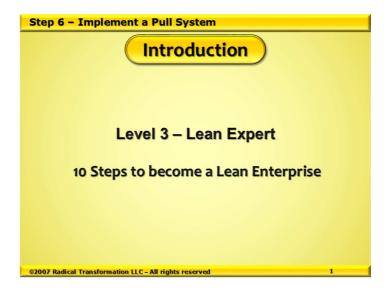
Lean Expert Training Course

Step 6
Implement a Pull System
Part 2

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Please note that some of the screens in the online course have been omitted from this workbook. This is to protect any proprietary information that may be included in the pictures.



Welcome.

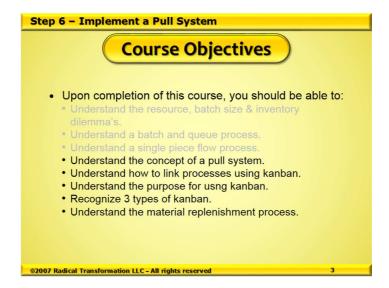
We would like to welcome you back to our next module in this online training course.

This training module is called "Step 6 – Implement a Pull System Part 2."

This module is a continuation of our Lean Expert online course series called "10 steps to become a Lean Enterprise."

This program has been specifically designed to demonstrate our step by step methodology that will allow any organization to become a Lean Enterprise.

Let's continue your lean journey!



Course Objectives

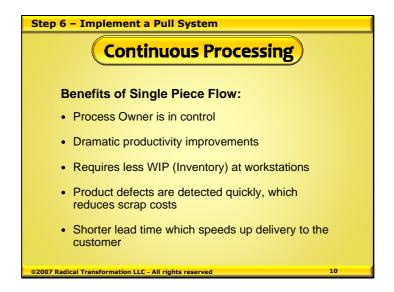
Here are the course objectives for Step 6 – Implement a Pull System.

We specially designed this course to give the information you need to get a full understanding of each step required to become a Lean Enterprise.

Upon completion of this course, you should be able to:

- Understand the concept of a pull system.
- Understand how to link processes using kanban.
- Understand the purpose for using kanban.
- Recognize 3 common types of kanban.
- Understand the material replenishment process.

Now we are going to work through each course objective.



Continuous Processing.

After looking at the animation in the previous screen, it demonstrated single piece flow or continuous processing.

Here is a list of some of the benefits of single piece flow:

- The process owner is in total control of their own workstation.
- There are dramatic productivity improvements.
- It requires less WIP/Inventory) at the workstations.
- Product defects are detected quickly, which reduces scrap costs.
- It has shorter lead times which will speed up the delivery to the customer.

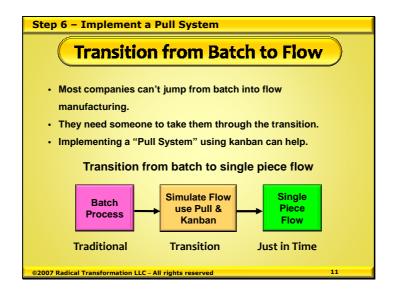
The individual operations at a workstation or in a cell are not isolated from the others throughout a production process.

They are connected by a single focus and this is the need to meet customer demand.

Every operation has to adhere to a common rate or pulse of throughput which is determined by calculating takt time.

If an organization has to produce a unit every 5 minutes, this rule applies to every operation that is working on this product.

If they are not synchronized they will not meet customer demand or takt time.



Transition from Batch to Flow.

One would think it would be an easy transition for any company to implement single piece flow.

However, most companies can't make the jump from batch and queue into flow manufacturing.

Why is this?

There are many reasons why a company is unable to transition from batch and queue into single piece flow.

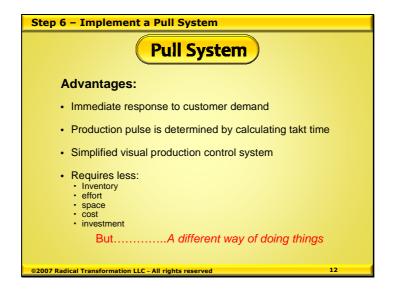
We will discuss two of them:

- 1. A traditional business uses inventory to hide its inefficiencies. Therefore, it cannot reduce inventory levels with long changeover times, high defect rates, etc.
- 2. The constraints in the system will not allow it to transition until it identifies these problems and eliminates them. This process will take time. How much time will depend on the business and its ability to change its culture?

Another issue is that most companies don't know how to start to improve their processes.

They need someone with experience to take them through the transition procedure.

The initial phase would be to implement a "pull system" using kanban to help them move closer to the goal.



Pull System.

We need to define a "pull system". It is a method of activating a production system when the customer consumes products or services.

It has certain advantages.

When a customer purchases a product it responds and sends a signal back through the production process to make and replenish the product or service.

The pulse of production is determined by calculating takt time.

A "pull system" is a simplified production control system because it requires less; inventory, effort, space, cost and investment. It is a totally different way of doing things.

A good example of a "pull system" is when you walk into the supermarket to buy bread and pay for the bread at the checkout counter.

The transaction sends a signal back to the person who is responsible for ordering the bread, telling them to buy more from the bakery. In turn, they contact the bread company and order more bread.

The bakery will bake and package the bread.

They will deliver the bread and very often their own employee who is driving the delivery van will replenish the shelves at the supermarket.

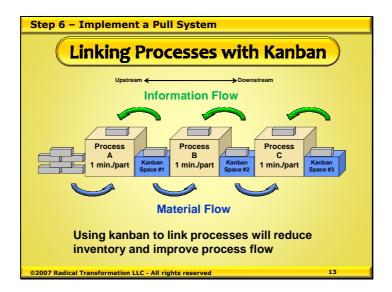
Taiichi Ohno got the idea for the "pull system" after a visit to the USA.

While there, he went into a supermarket and observed an employee replenishing items on the shelves.

He implemented the pull system at Toyota, and it became an integral part of the Toyota Production System (TPS).

When a business is transitioning from a traditional batch and queue system to single piece flow it is often difficult to achieve a continuous flow in the early stages.

A pull system using kanban to signal when to replenish items can smooth out some of these initial flow issues.



Linking Processes with Kanban.

In this screen, you can see the same three processes from the batch and queue and single piece flow examples.

This animation will demonstrate how to use kanban to control the production though all three processes.

Each process is connected or linked using kanban.

This is a visual location where an item will wait until it is needed.

Look closely at the first movements in the animation!

They will graphically demonstrate the information and material flows, just the same way as they are defined in a value stream map. Information flows upstream (right to left) towards the supplier, while the material flows downstream (left to right), towards the customer.

When an item is removed from a downstream kanban space such as kanban space #3, it signals the worker at Process C to pull the next available item from the next upstream kanban space #2 and produce another one.

This will replenish the empty downstream kanban space #3.

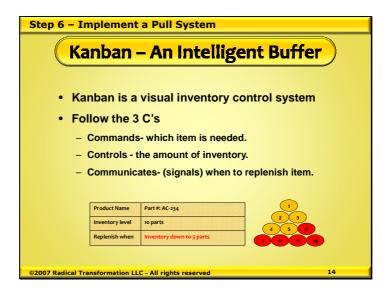
These same activities will be triggered in kanban spaces #2 and #1.

Watch the rest of the animation to see it go through a full cycle to replenish all three kanban spaces.

There is one important point to remember, this example has one item in the kanban space, but it could hold many items (10's, 100's, etc.).

The kanban quantity will be determined by customer demand.

We will discuss kanban quantities in the following screens.



Kanban - An Intelligent Buffer.

As you have been working through this online training course, you have seen the word "Kanban" used several times.

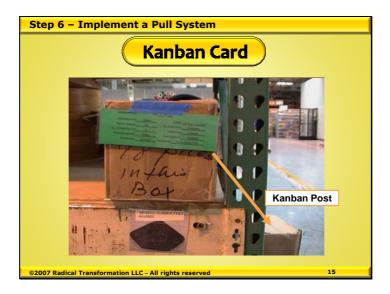
It is very important to understand the meaning of this word. Kanban is a Japanese term that means "signal or card".

Kanban is often referred to as an intelligent buffer or a visual inventory control method.

Kanban integrates what has come to be known as the three C's:

- It commands which item is being replenished and/or produced next.
- It **controls** the amount of inventory at the workstation to a pre-determined level to ensure the production process can meet customer demand. The pre-determined level of inventory is called "Standardized Work In Process (SWIP)".
- It **communicates** visually when to replenish parts and/or materials.

As mentioned in previous screens, Kanban can be effectively utilized by any organization to help when it is transitioning from batch processing to single piece flow.



Kanban Card.

In this screen, there is a box of parts with a kanban card attached to it.

Once the box of parts is opened the kanban card is removed and placed into a tray or kanban post.

You can see from the example in this screen that the kanban cards can be color coded by work area or cell.

A materials person or water spider picks up the card and drops it off at the purchasing office.

A person in the purchasing office re-orders the parts using the specific supplier information written on the card.

They will see the following information on the kanban card:

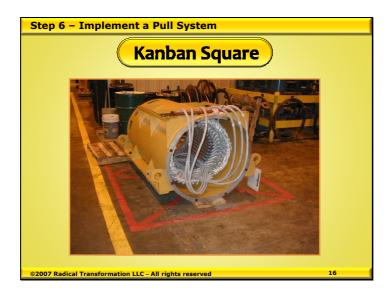
- Part number
- Part Description.
- Re-order quantity.
- Supplier name, address, phone number, etc.
- Purchase order information

The purpose of putting this information onto the kanban card is to speed up the reordering process.

The replenishment time, which is the time the work area puts the card into the kanban post until the re-ordered parts are put back onto the shelf will be calculated using takt time.

The quantity of parts to be re-ordered will need to be enough to allow the work area to continue producing until the parts are replenished.

If this is miscalculated and not enough parts are ordered, it will cause a stoppage.



Kanban Square.

In this screen, there is an example of a kanban square.

A kanban square is a visual location, usually on the floor, where a finished part or subassembly can be placed.

The square or rectangle will create a signal to indicate when to start and stop the production process.

When the part is removed from the kanban square, it instructs the operator to make another part and replenish the empty kanban square.

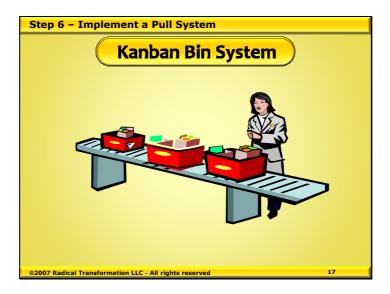
The purpose of using kanban is to control the flow and quantity of parts being manufactured.

The kanban quantity will be influenced by takt time or customer demand.

The rule for a kanban square is simple to follow:

Empty kanban square, make one.

One in the kanban square, don't make any.



Kanban Bin System.

In the screen, there is an example of an inclined table using bins of parts to replenish a workstation or cell.

This feeder line is using a 3 bin system, however there are also single and two bins systems.

When the parts in the first bin have been used, it is removed and placed in a designated location where it will wait to be refilled.

Once the bin has been refilled it is placed back onto the inclined rack.

The replenishment cycle repeats whenever there is an empty bin.

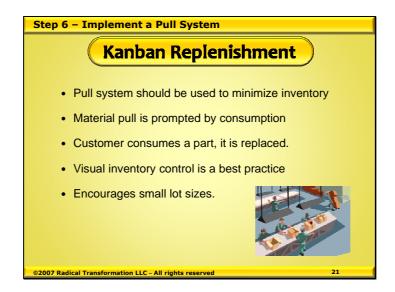
The part quantities in each bin have been determined by calculating the takt time.

This allows the water spider enough time to replenish an empty bin and return it to the cell.

The cell or workstation should never run out of parts if the bins are replenished correctly.

Multiple kanban bin systems are very popular in a Lean Enterprise.

They can be color coded for different types of parts or cell locations to ensure items do not get mixed up.



Kanban Replenishment.

A pull system should be used to minimize the amount of inventory throughout a process.

It should be designed in such a way to control the flow and amount of inventory.

There should always be enough to meet customer demand but never to little inventory to stop the line.

When using a pull system with kanban to replenish items, the movement of parts and/or materials is prompted by downstream consumption of a finished product or service

When a customer purchases or consumes a part, one must be created to replace it.

The concept is to allow this process to activate production from the finished goods department back along the internal value stream to the receiving department.

This is the purpose of a pull system.

In a batch and queue system the products are pushed through the process from raw materials towards finished goods.

In a push system the production process is activated using a forecast and by scheduling work through the production system as the available capacity opens up at each operation.

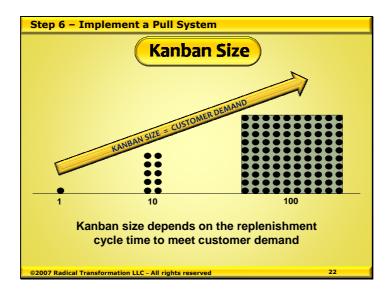
Implementing visual inventory control using kanban is a best practice.

A Lean Enterprise will use this system to manage its replenishment and production processes.

The main advantage of implementing a pull system is that it encourages smaller lot or batch sizes.

The lots sizes must be right sized to synchronize the delivery schedule to "takt time".

The kanban quantities will be calculated, defined and implemented as standardized work in process or SWIP.



Kanban Size.

Kanban size is based on customer demand, which is determined by using a formula to calculate "takt time."

When customer demand changes, the takt time will change and so will the kanban size.

It is important for an organization to monitor this so they don't over or under produce. Kanban can be sized to contain 1, 10's, or 100's of parts.

However, the kanban must be sized correctly to meet customer demand.

The actual number of parts in a kanban will depend on how long it takes for a supplier to receive an order, make the parts, and deliver them to replenish the parts in the kanban.

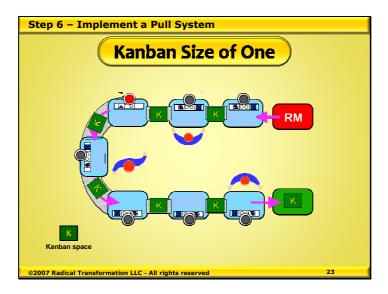
This period is called "the replenishment cycle time".

The kanban size must contain enough parts to allow an operation to continue working until the order from the supplier arrives.

The length of the replenishment cycle is a factor that will influence the size of the kanban:

- The longer the replenishment cycle time, more parts are needed in the kanban.
- The shorter the replenishment cycle time, fewer parts are needed in the kanban.

As an organization eliminates waste and improves their operational effectiveness by implementing workplace organization, reducing changeover times, balancing the workload, etc., their kanban sizes should continue to reduce over time.



Kanban Size of One.

In a Lean Enterprise there is an ideal practice for implementing kanban.

The ideal practice is a kanban size of one. This is the most effective use of kanban.

In the graphic on the screen, you can see a U type cell.

The cell has a series of operations or workstations.

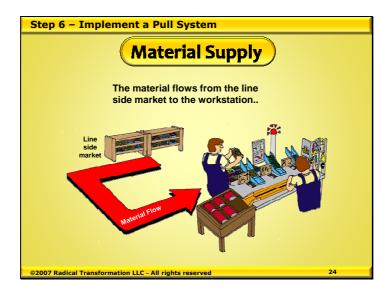
In between each workstation is a designated kanban space (represented by a green square with a capital K).

When the kanban space is empty, it informs the worker who is responsible for the workstation to make another part and place it into the empty kanban space.

This is an ideal state for production and inventory control to meet a defined customer demand.

The workers in the cell in this screen are working on one item per time.

This is what one piece or single piece flow is supposed to look like.



Replenish the Materials.

In Step 4 – Improve Process Flow Part 2, we discussed the replenishment process for different cell or workstation designs.

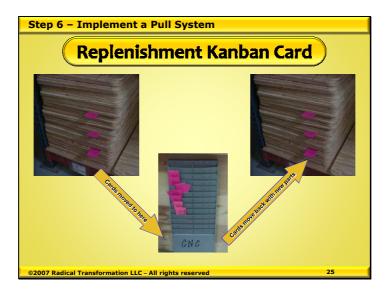
In this screen, we will re-cap on this to help make the connection about replenishing materials in a pull system.

It is using the same principles discussed in Step 4 – Improve Process Flow.

It is standard practice to use a person called a "water spider" to replenish materials to each workstation in a cell.

The materials are often staged in a line side market. In this screen you can see the red arrow which represents the material flow from the line side market to the workstation.

The water spider will deliver the products to the workstation at set intervals based on takt time.



Replenishment using a Kanban Card.

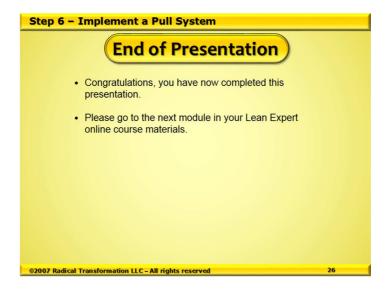
In this screen you can see an example of a company that is using kanban cards to signal and replenish parts in a cell.

This type of card is called a "production" kanban. Its purpose is to signal and initiate the production of an item to replenish a supermarket or line side market.

The process is described here:

- 1. As parts are consumed a kanban card is uncovered (picture on the left of the screen). You will notice there are enough products before the next kanban card to keep production flowing.
- Next, the uncovered kanban card is taken to the CNC machine and put into a card rack to place it in the work queue. The CNC operator will work through each card in turn and only make the number of parts written on the kanban card (middle picture).
- 3. Once the parts have been completed the kanban card is returned with the parts to the work area or cell (picture on the right).

The kanban cards in this example are color coded by workstation or cell.



End of Presentation.

Congratulations, you have now completed this presentation.

Please go to the next training module in your Lean Expert online course materials.

Reference Materials

1. Pull Production for the Shop Floor:

By: Productivity Press Development Team. Published by Productivity Press 2002.

2. Kanban for the Shop Floor:

By Productivity Press Development Team. Published by Productivity Press 2002.

3. Kanban Made Simple:

By John M. Gross and Kenneth R. McInnis. Published by AMACOM 2002.

4. Kanban for the Supply Chain: Fundamental Practices for Manufacturing Management.

By Stephen Cimorelli. Published by Productivity Press 2005.

Documents List

There are no documents required for this training module.