



# Pull Kanban

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## Key Talking Points

- Definition of a Pull System
- Difference between Pull and Push
- Where and when do you pull?
- Types of pull signals
- Identify supermarket requirements
- Maintaining a Pull System



## Defining Lean

### Lean Is:

“A systematic approach to identifying and eliminating waste (non-value added activities) through continuous improvement by flowing the product at the pull of the customer in pursuit of perfection”

- The MEP Lean Network

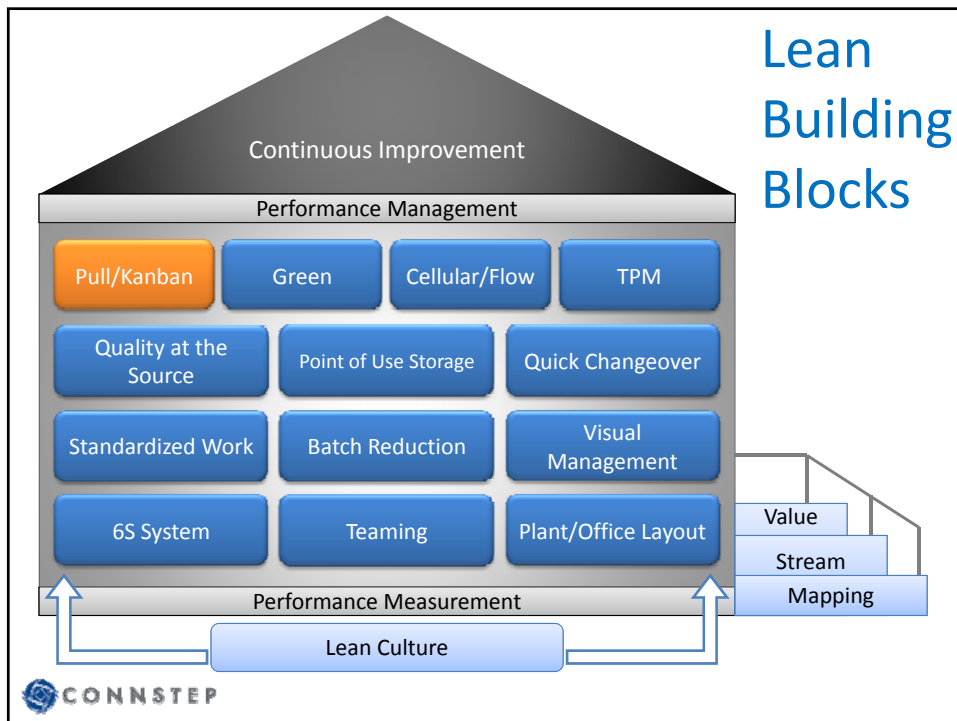
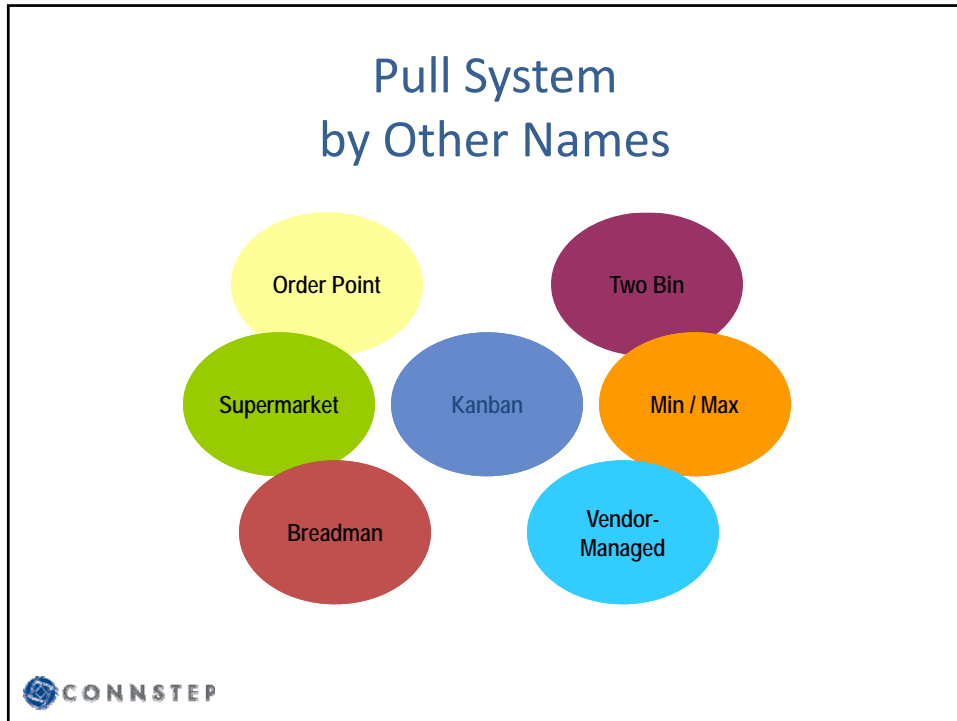


## What is a Pull System?

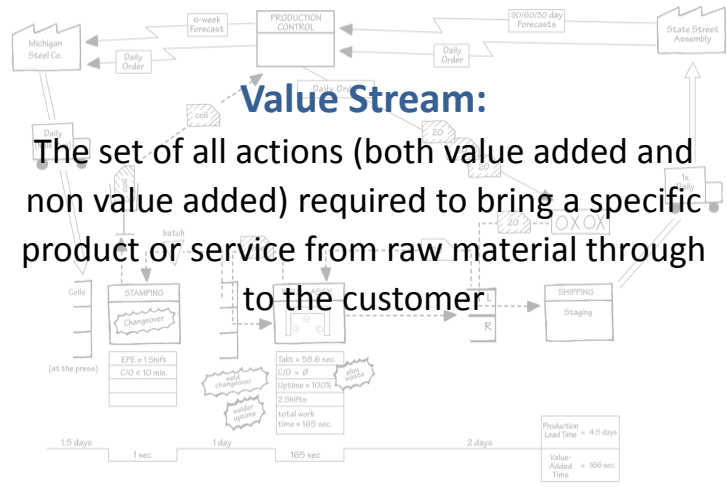
### An information system for:

- Controlling and improving the flow of materials and information
- Allocating resources based on actual consumption, not on forecasted demand

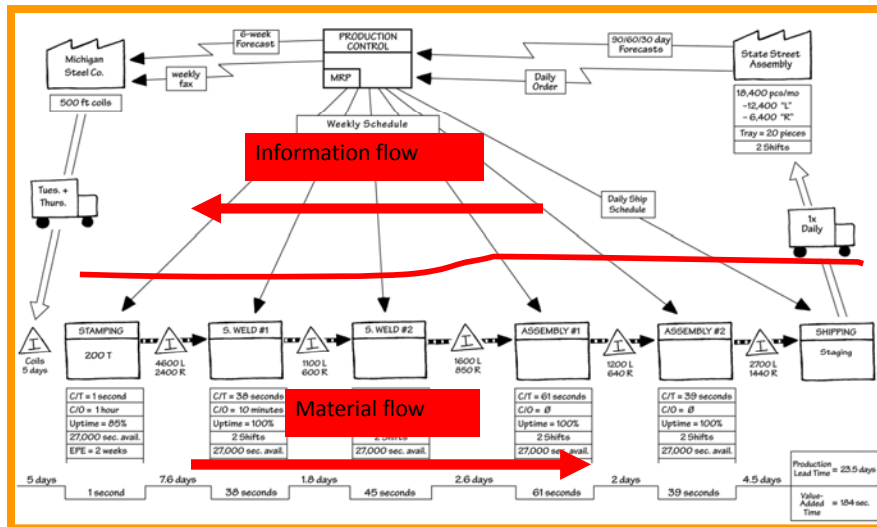




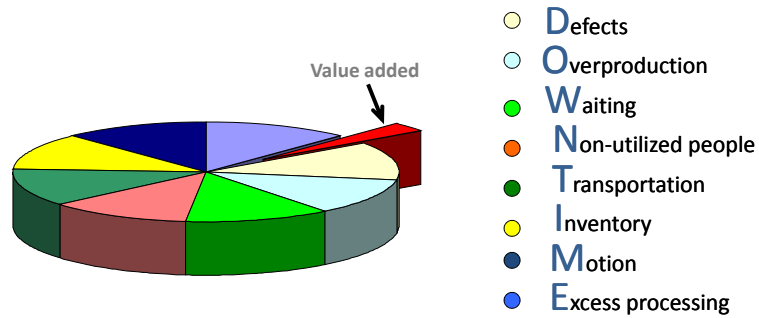
# Value Stream Mapping



# Current State Value Stream



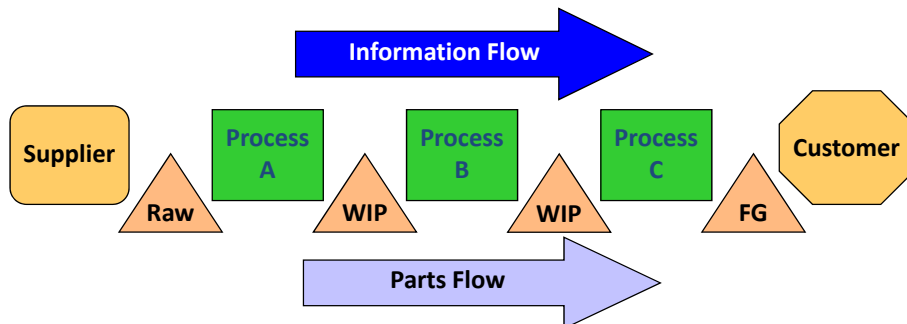
## Lean = Eliminating the Wastes



Typically 95% of Total Lead Time is Non-value added!!!

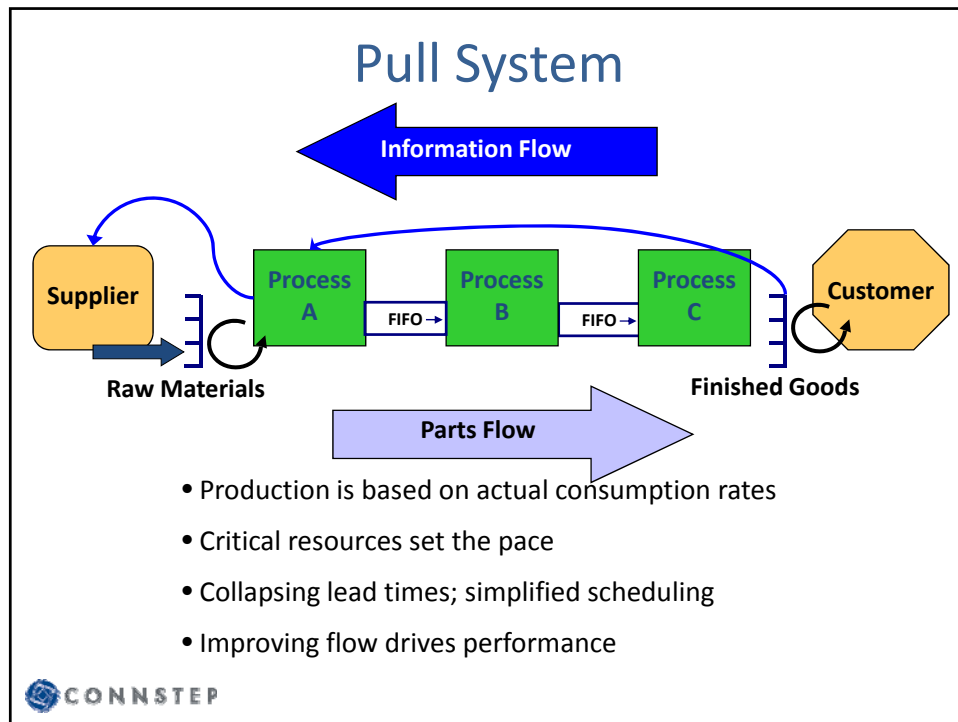


## Push System



- Production is based on anticipated need dates
- High utilization and high efficiency drive performance
- Infinite capacity is assumed
- Constraints are hidden and lead times expanded
- Maintaining flow is costly





## The Strategic Nature of Inventory

- The size of your inventory relates directly to the percent of your lead time that is non-value-added!
- High inventory manufacturing destroys:
  - Quality
  - Delivery
  - Margins
- Inventory is a measure of total manufacturing effectiveness.

## What is the plan?

- The plan is specific
- The plan is timely
- The plan is communicated



## Pull System

### **Not Required**

- A wealth of data
- Accurate forecasts
- Eliminating MRP

### **Required**

- A champion with vision and authority
- Value stream management
- User ownership and customer focus
- A comprehensive approach

Needed: a deep commitment to Lean strategy



## Information You Will Need

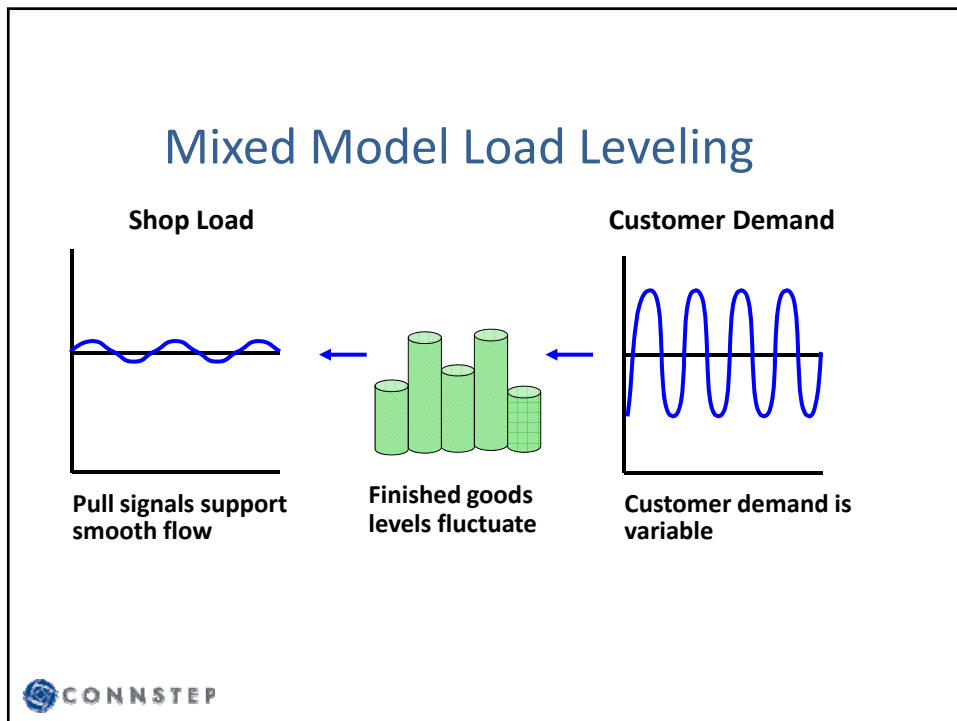
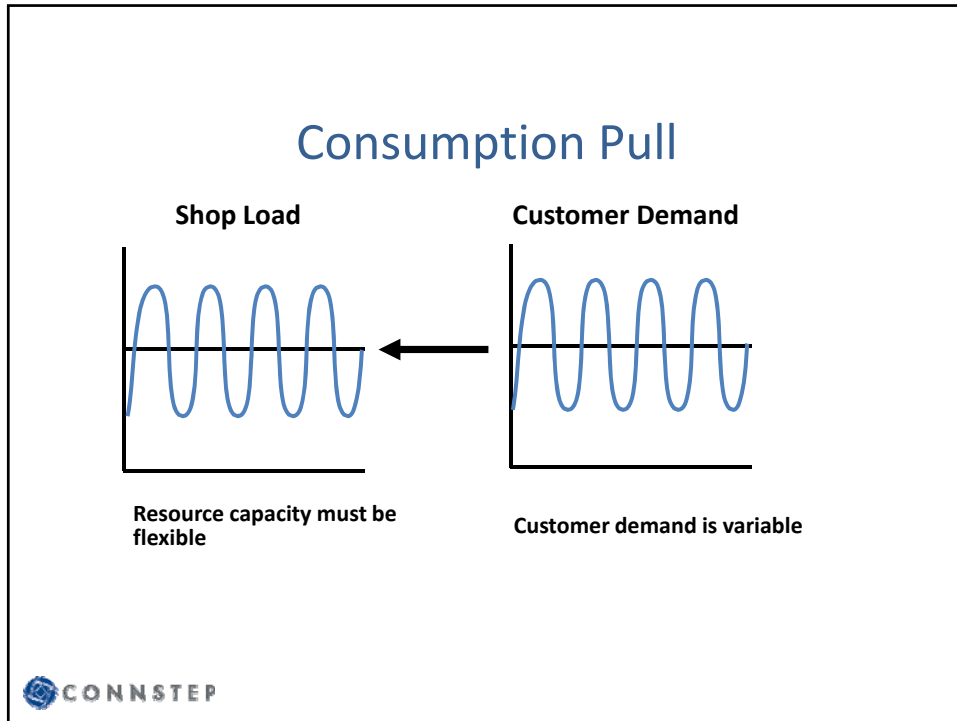
- Which 20% of your end items consume 80% of your capacity?
- Does your lead time to produce exceed your customer's required lead time?
- Do spike demands cause your lead time to expand?



## Demand Pareto Analysis

PART	TOTAL	MONTHLY BACKLOG											
		May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	
77080	397	16	33	37	52	30	35	44	16	38	41	40	
10015	368		20	15	63	37	40	43	30	17	46	29	
68144	300							300					
27272	250		21		19	29	29	21	33	32	22	22	
14590	205	100				30				75			
23303	200		50			50			50			50	
65318	175	12	3	10	28	16	17	15	13	21	19	19	
48907	166	10	4	10	23	16	17	15	13	16	19	19	
85987	162	8	20	11	10	13	26	16	7	14	13	14	
94265	162	5	20	11	10	13	26	16	7	14	13	14	
92912	87	2		3		8		7				8	
49050	80		80										
86184	79	9	6	10	8	9	9	9	9	9	10		
23394	79	6	11	10	10	8	7	6	8	8	7	4	
90801	72	7	7	7	7	7	7	7	7	7	7	7	
95317	70	2	8	5	8	9	4	8	6	6	4	5	
30110	50								50				
99403	40					40					40		
69932	33	10				5			6			12	
20828	25									25			
60026	20	20											
62259	20		20										
94602	20						20						
58267	20				10						10		
93742	10	10											
34405	5				5								
98961	5	5											





## The Goal: Making Money

- **Increase throughput**—the rate at which money is generated through sales
- **Decrease inventory**—the money invested by *purchasing* things intended for sale
- **Decrease operating expense**—the money spent to convert inventory into throughput



## Where Do You Need Supermarkets?

### At critical points in the flow:

- Where supply time is greater than customer lead time
- Where spike demands cause lead times to extend
- Before divergence points, assembly points, and constraints
- After unpredictable operations
- Before and after long setups



## How Can You Level the Load?

- Set supermarket levels
- Set an assembly schedule to maintain supermarkets



## Sizing the kanban/supermarket buffer

The buffer size is equal to the maximum expected consumption within the average RT, plus additional stock to protect in case a delivery is late. In other words, there is no advantage in holding more inventory in a location than the amount that might be consumed before more could be ordered and received.



## What Do You Need to Do?

1. Decide where you need supermarkets
2. Calculate the order point and order quantity for replenishment
3. Adjust your calculations for real world logistics



## Order Point and Order Quantity

- The **order point** is the point at which you request replenishment for your supermarket
- The **order quantity** is the amount that you order to replenish a supermarket



## Formula for Preliminary Order Point

$$\boxed{\text{Daily Requirement}} \times \boxed{\text{Replenishment Lead Time}} = \boxed{\text{Preliminary Order Point}}$$



## Formula for Preliminary Order Quantity

For purchased part or raw materials:

$$\boxed{\text{Daily Requirement}} \times \boxed{\text{Frequency of Supply}} = \boxed{\text{Preliminary Order Quantity}}$$

For manufactured items:

$$\boxed{\text{Daily Requirement}} \times \boxed{\text{EPE Interval}} = \boxed{\text{Preliminary Order Quantity}}$$

What is the EPE Interval?



## EPEI or EPE Interval

- Refers to the “**every-product-every interval**”—a measure of production batch size



### Example

If a machine is able to change over and produce the required quantity of all the part types dedicated to it within three days, then the production batch size for each individual part type is about three day's worth of parts. The machine is making every part every (EPE) three days.



## Calculating EPE Intervals

EPEI is calculated from:

- Capacity of the producing resource
- The setups and run rates of the parts produced on the resource
- Volume of demand for the parts over an appropriate horizon



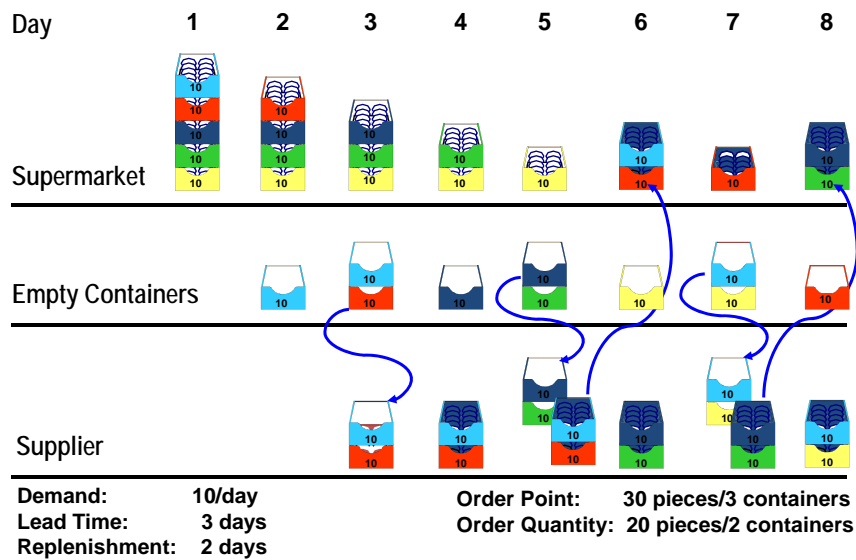
## Adjust your Calculations for Logistics

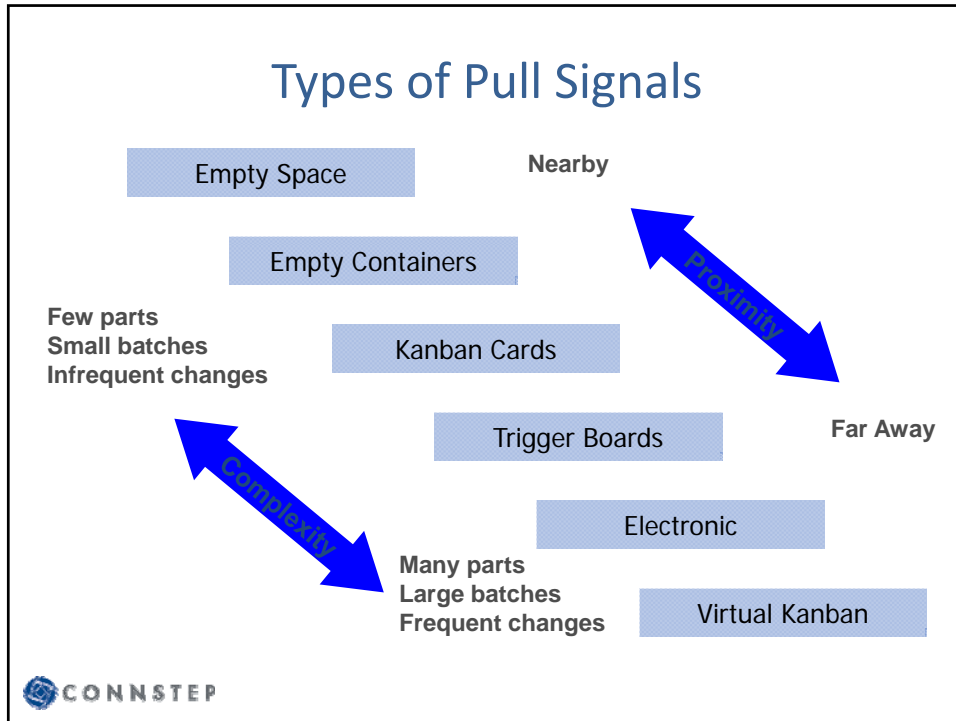
Logistics considerations:

- Container quantities
- Supplier schedules



## Executing a Pull System





### Performance Measurement

**Measure:**

- Throughput (on-time delivery, actual output instead of required output)
- Inventory (cycle time, weeks of inventory)
- Operating Expense (output per person)

**Avoid using:**

- Efficiencies: amortized setups
- Earned hours: unless hours of output
- MRP date-based measures

The word 'PULL' is written in large, purple-outlined letters. A blue triangle is superimposed over the letters, with its base at the bottom and its apex at the top, pointing downwards. This triangle is positioned behind the 'PULL' text on both the left and right sides of the slide.

**CONNSTEP**

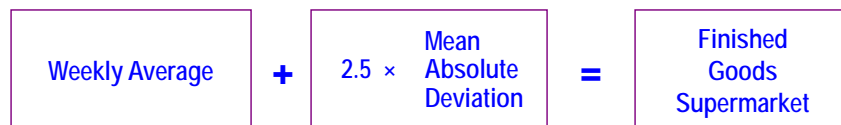
## Keys to Success

- Vision and authority
- Value stream management
- Cross-functional involvement
- Structured implementation planning
- Interfaces with other systems
- Ease of maintenance
- Flow-oriented performance measures



## Supermarkets

How much is enough?



Mean absolute deviation is a statistical function which measures the extent of demand variability.

Mean Absolute Deviation

$$MAD = \frac{1}{n} \sum_{i=1}^n |x_i - \bar{x}|$$



## Sizing the Kanban Buffer

Confidence Interval	Value
99%	2.36
97.5%	1.96
95%	1.645
90%	1.44
87.5%	1.15
85%	1.036

$$s_{N-1} = \sqrt{\frac{1}{N-1} \sum_{i=1}^N (x_i - \bar{x})^2}$$



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