
"Value Stream Mapping – **How does Reliability play a role in making Lean Manufacturing a Success** "

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Lean Manufacturing

What is Lean Manufacturing?

A philosophy which shortens the timeline between the customer order and the shipment by eliminating waste which cause waiting and queues.

The concepts can be applied up and down the “Value Chain” to create a Lean Enterprise

Lean Manufacturing

Where are we implementing Lean Manufacturing?



Lean Manufacturing

Why do we need Lean processes?

– Overall TOP 4 Customer buying priorities:

- **Price/Value**

- ≤ Customer only pays for what is of value to meet their requirements. Product design is critical.

- **Quality**

- ≤ Quality is expected. It's the ante. Many customers no longer perceive quality as a positive differentiator (only negative)

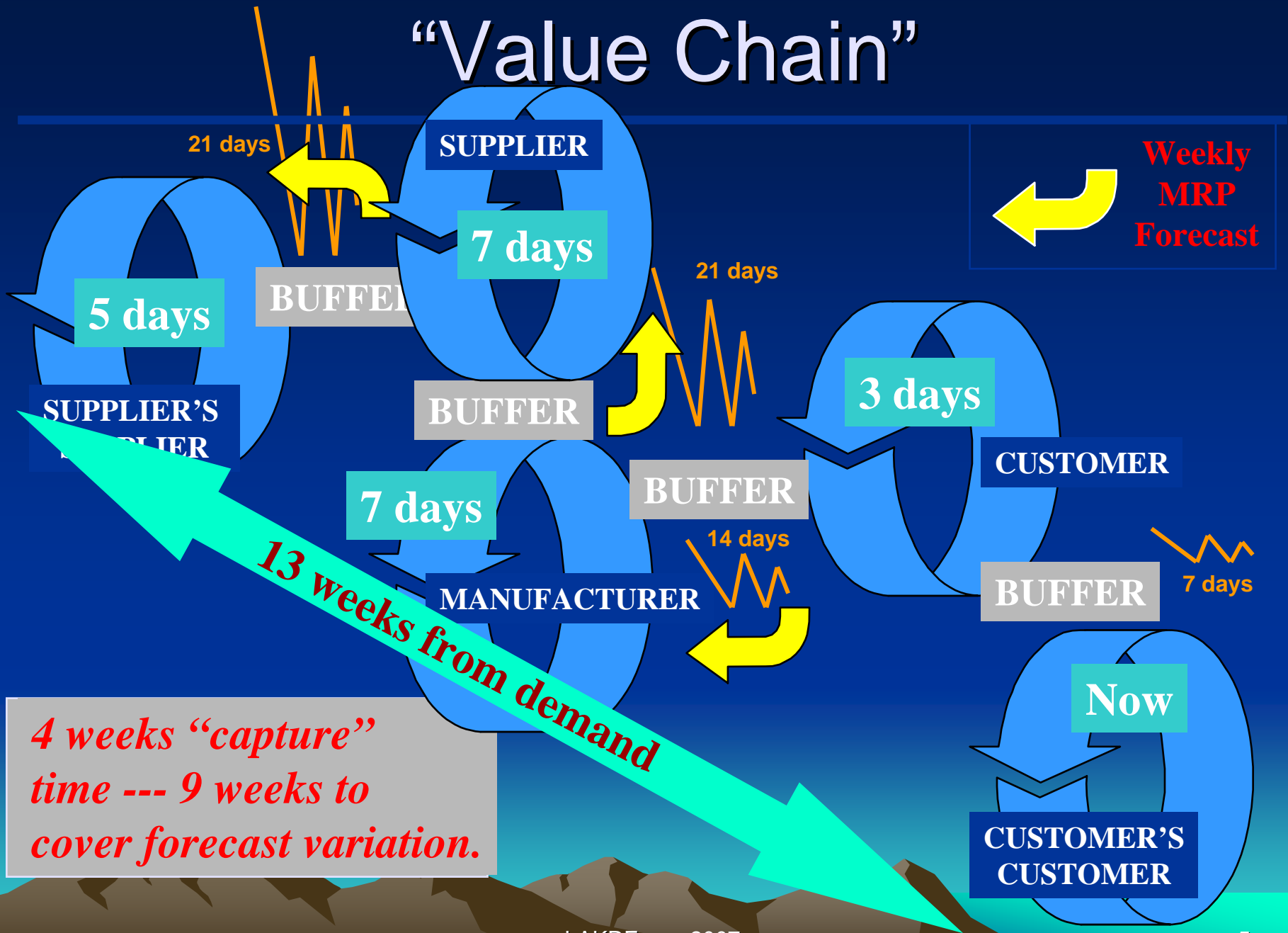
- **On-Time Delivery**

- ≤ *Customers want to do business with reliable suppliers. It costs the customer money if we're late (and sometimes early). Key for contractors & project orders!*

- **Lead Time**

- ≤ *SPEED to the customer is THE differentiator in the MRO and service world! Small P/D ratio requires contractors to "forecast" less.*

"Value Chain"



Seven Pillars of a Lean Six Sigma Model

- ***Establish a Foundation for Improvement***
- ***Value Stream Management***
- ***Lean Manufacturing***
- ***Lean Business Processes***
- ***Six Sigma***
- ***Supply Chain Execution***
- ***Demand Management***

STRATEGY

- "Gaps"
- Goals

Financial Targets

Voice of the Customer

VALUE STREAM MANAGEMENT

"Seeing the Whole Process – Order to Cash"

SUPPLIERS

Lean Ready

Information Management

DEMAND MANAGEMENT

"Consistent Flow of Orders"

SUPPLY CHAIN EXECUTION

"Reliable Flow of Materials"

LEAN BUSINESS PROCESSES

"Fast, Error-free Transaction Flow"

E-signal

SIX SIGMA

"Eliminating / Managing Variation in Manufacturing and Business Processes"

Daily Sequential Schedule (Level Loaded)

C

FIFO

C/T = 45 sec

C/T = 45 sec

DOE

FIFO

SHIP

C/T = 45 sec

C/O = 30 mins

3 Shifts

2% Scrap

LEAN MANUFACTURING

"Fast, Waste-Free Manufacturing Cycle Time"

Changeover

C

Equipment Uptime

C/T = 45 sec

C

C/T = 45 sec

1-piece Flow

FOUNDATION ELEMENTS

5S+1, Employee Engagement, Problem Solving, Project Management

Foundation Elements – Readiness for accelerated performance improvement

- **5S + 1** --- Organized, clean, sustainable workplace plus a strong focus on SAFETY
- **Employee Engagement**
 - Clear reasons for change
 - Vision of the Future State
 - Plan and resources to make it happen
 - **Education and training to foster contribution**
- **Problem Solving**
 - Teamwork tools
 - Root cause identification
 - Control / Sustain improvement
- **Project Management**
 - Identifying / controlling the scope
 - Work Breakdown structure
 - Milestone Management
 - Project tracking

LEAN MANUFACTURING

“Fast, Waste-Free Manufacturing Cycle Time”

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VALUE STREAM MANAGEMENT

"Seeing the Whole Process – Order to Cash"

Value Stream Management – Strategic, Tactical and Operational planning for Improvement

- Identifying **strategic priorities** for the business
- Analyzing and identifying **"gaps" in performance** that must be closed
- Setting specific goals for improvement in:
 - **customer service**
 - **asset efficiency**
 - **productivity**
 - **quality**
- Developing the **Current State**; identify key performance drivers
- Envision the **Future State** to achieve the goals
- Identify specific **improvement actions** and the tools to accomplish those actions
- Develop an **action plan** with scope, time and resources required
- Allocate **resources**

5S+1, Employee Engagement, Problem Solving, Project Management

STRATEGY

Financial Targets

Lean Manufacturing – producing products in a waste-free manner with the shortest cycle time and investment of minimal resources

- Understand customer **demand requirements**
- Design production to meet demand in the **shortest possible cycle time**
- Identify and **eliminate non-value-adding** activities
- Develop **standard work** and flexible workforces
- **Visual controls** for quality and repeatability
- **“Pull”** materials and components through the process
- **Reduce lot sizes** with Set-Up reduction
- Improve **equipment utilization** with Total Productive Maintenance
- **Mistake proof** processes
- Instill a “kaizen” culture (**continuous improvement**)

LEAN MANUFACTURING

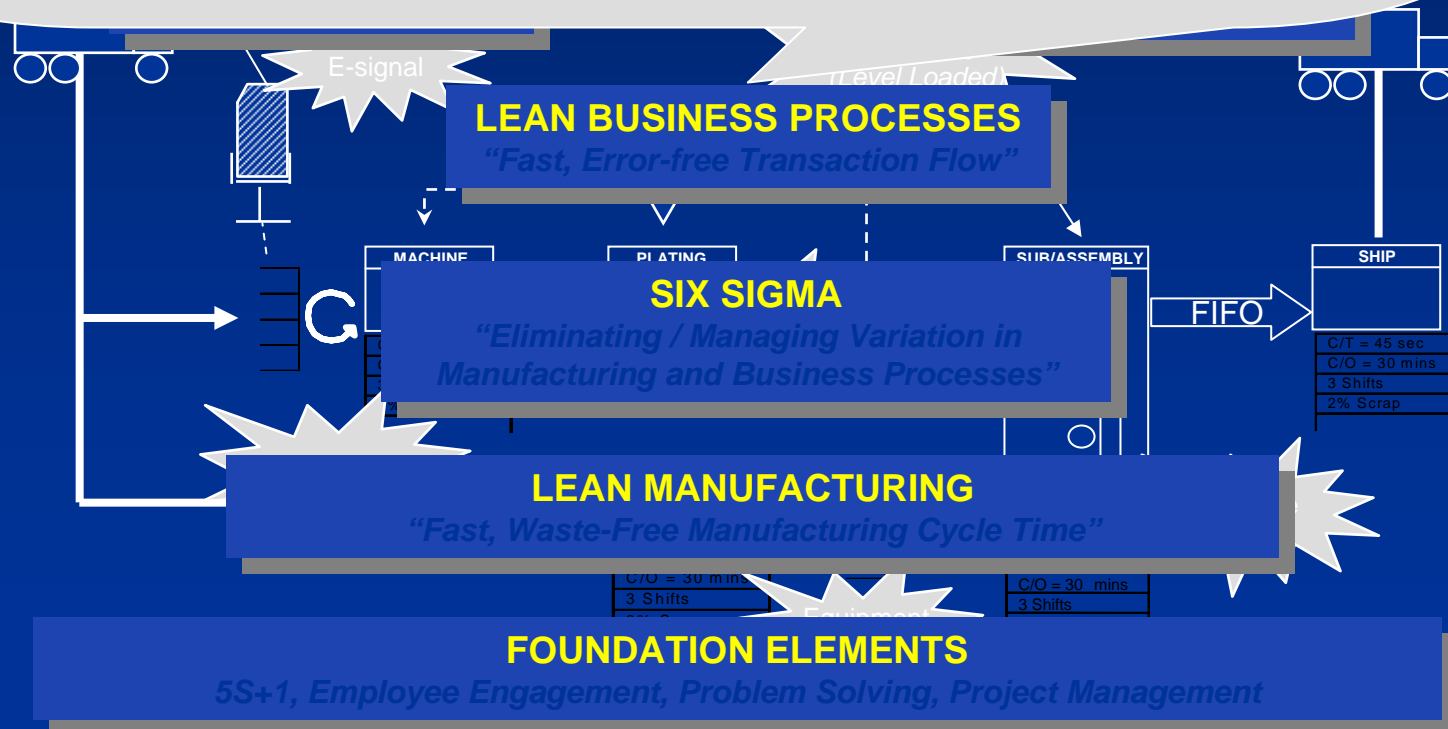
“Fast, Waste-Free Manufacturing Cycle Time”

FOUNDATION ELEMENTS

5S+1, Employee Engagement, Problem Solving, Project Management

Lean Business Processes – achieving the desired output from a business process in a waste-free manner in the shorter Possible cycle time

- Understand downstream customer **demand requirements**
- Design process flow to meet demand in the **shortest possible cycle time**
- Identify and **eliminate non-value-adding** activities
- Develop **standard work** and flexible workforces
- **Visual controls** for quality and repeatability
- **“Pull”** paperwork and transactions through the process
- **Mistake proof** processes
- Deploy **e-business** tools to the new process
- Instill a “kaizen” culture (**continuous improvement**)



Six Sigma – elimination of “variation” to improve productivity and quality and create quality products the first time

(Quality Improvement) Identify “variation” that causes waste or defects

Define the problem and desired outcome

Measure the current output and key inputs

Analyze the data to determine root causes and critical to quality inputs

Improve the process by eliminating root causes and improving CTQ inputs

Control the process to prevent recurrence

(Design) Identify Critical to Quality requirement of customers

Define the project goals and customer deliverables

Identify customer needs and specifications

Design the product/process to meet the customer needs

Optimize the design for performance and cost effectiveness

Validate the design performance and ability to meet customer needs



STRATEGY

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VALUE STREAM MANAGEMENT

"Seeing the Whole Process – Order to Cash"

SUPPLY CHAIN EXECUTION

*"Reliable Flow of
Materials"*

Information
Management
and Flow

DEMAND MANAGEMENT

*"Consistent Flow of
Orders"*

Supply Chain Execution – ensure a reliable , quality flow of materials into production

- **Measure** Supplier Performance
- Identify **required flow** of materials
- Joint **Value Stream Mapping**
- Determine appropriate method to **release orders** (kanban, MRP, combination)
- Create **"Pull"** environment
- Deploy **e-business** as appropriate
- **Train** Suppliers in Lean and Six Sigma
- Identify **Joint Projects**

STRATEGY

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VALUE STREAM MANAGEMENT

"Seeing the Whole Process – Order to Cash"

SUPPLIER

Lean
Ready

SUPPLY CHAIN EXECUTION

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DEMAND MANAGEMENT

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CUSTOMER

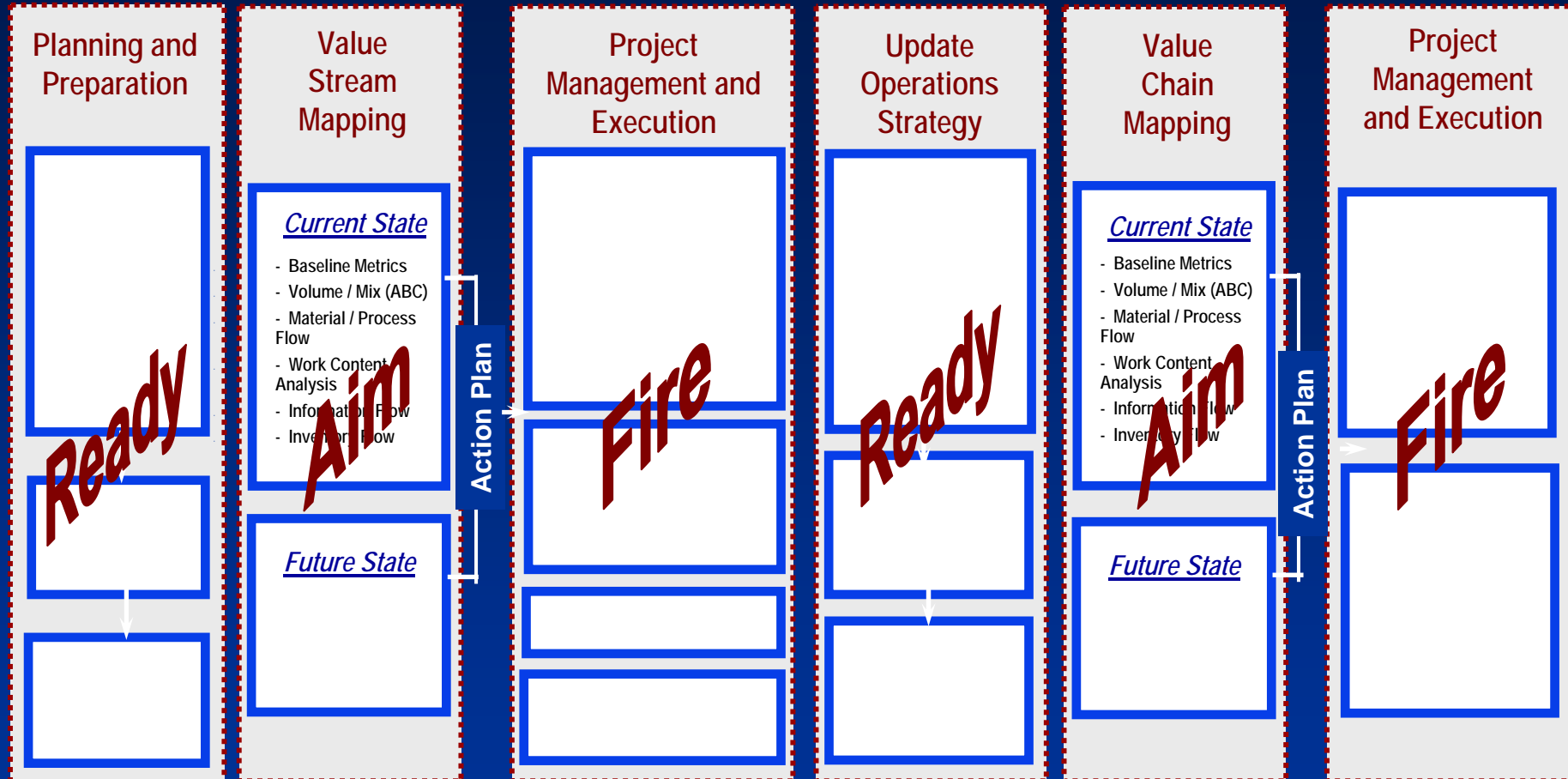
E-signal

Daily Sequence
Scheduling
(Level Loading)

Demand Management – ensure frequent, consistent flow of orders

- Analyze **Order Patterns**
- Identify root causes for **inconsistent demand** (internal, external)
- Identify **Consumption Patterns**
- Joint **Value Stream Mapping**
- Create a **"Pull"** environment
- Deploy **e-business** as appropriate
- **Train/ Participate** with Customers in Lean and Six Sigma
- Identify **Joint Projects**

“How To” - The Path to Lean Six Sigma



Establish Foundations:

Lean Implementation Stages

- **Stage 1**
 - Define product families that have similar market expectations, process flows, and engineering content
 - By product family, establish the Lean vision and operations strategy
 - Educate and involve everyone
- **Stage 2**
 - Map the current state process material & information flows
 - Establish baseline metrics for lead time, On-Time-Delivery, productivity, quality, etc. by product family
 - Develop the future state, an **ACTION PLAN** and a schedule for implementation!

Lean Implementation Stages

- **Stages 3 - 5**
 - From the future state action plan/schedule, start to apply Lean tools
 - Link processes together to minimize queues and establish flow
 - Identify and eliminate/minimize waste in our processes
 - Keep materials and information moving from start to finish
 - Operate processes to customer demand vs. MRP
 - Improvement focus on “speed to the customer” rather than “speed of my operation/process”
 - Improve and perfect the process flow
 - Link customers and suppliers to our processes

Start By Linking Processes

- What are linked processes?
 - Linked processes are driven by actual consumption and WIP is controlled by sequenced & synchronized replenishment signals
- Why do we link processes?
 - To generate desired flow, process steps must be linked together
 - Isolated islands working efficiently may not come together to make a product
 - Component and subassembly flows must be synchronized to satisfy the customer

Tools to Pull & Perfect - Value Stream Mapping

- What is a Value Stream?
 - All the actions required to bring a product through the *material, information, and resource* flows essential to fulfilling every customer's order
- What is Value Stream Mapping?
 - A tool that provides a pictorial look to help understand the process... see the value... and envision a future state.

Tools to Pull & Perfect - Value Stream Mapping

Why Map the Value Stream?

- Shows the linkage (or lack of linkage) between information flow and the material flow
- Develops the ability to “see” the total process flow and relationships... beyond the single process level
- Formulates a picture of the total process that all levels of the company can understand... how each group fits into the total process
- Helps identify the sources of overproduction & other waste
- Helps establish priorities based on barriers to overall process flow
- Forms the basis of the implementation plan

Tools to Pull & Perfect - Kaizen “Blitz”

- Kaizen “Blitz” Events
 - Aggressive, short time frame team improvement projects
 - Small focused team attacks a specific problem and implements improvement during 3-5 day focused event
 - Areas requiring kaizen events should be identified from value stream map
 - Isolated kaizen events alone will not move dollars to the bottom line in a major way
 - To gain and sustain full benefit of the kaizen tool, there must be a vision of the Future State flow and understanding of how kaizen will help achieve Future State

Value Stream Vision

- Strategic Business Plan
 - Customer to supplier (whole value chain)
 - For developing new, or improving old and existing products
 - Includes all information flows and delays
 - Includes all material flows and delays
- Value Stream Mapping Process
 - Value stream your product families
 - Current state(Baseline, Identify Opportunities)
 - Future state (Lean plan)
 - Prioritize improvement plans to get there
 - Measures to assess your journey

Value Stream Mapping

What are the benefits ?

- Visualize the entire material & information flow of a product family (Current State)
- See the sources of waste
- Identify improvement opportunities
- Create a vision of an “ideal” or at a minimum improved state
- Focus Priorities - Prioritize the opportunities into a “door-to-door” implementation plan (Future State)the expected results being dramatic improvements in cost, quality, & throughput in both manufacturing and business processes
- Ties together lean concepts and techniques...helps avoid “cherry-picking”
- Measure - Match the improvement plan against your Strategic objectives

Value Stream Mapping

- **Business Model Approaches**
 - Build to Stock – Generally high volume/low mix products requiring very short lead-times
 - Assemble to Order – Platform type products – standard components with some variation that can be configured to order
 - Build to Order – Generally highly engineered
 - products with high component & design variation
 - Combination of techniques....ABC

Determine Product Families

- **First, select the product line based on Strategic Implications....Growth, Market share, profitability etc**
- **Group by Similarities of:**
 - Similar Product / components
 - Engineering content
 - Products that pass through similar processing steps
 - Similar Work Content (ABC stratification)
 - Similar Market Expectations

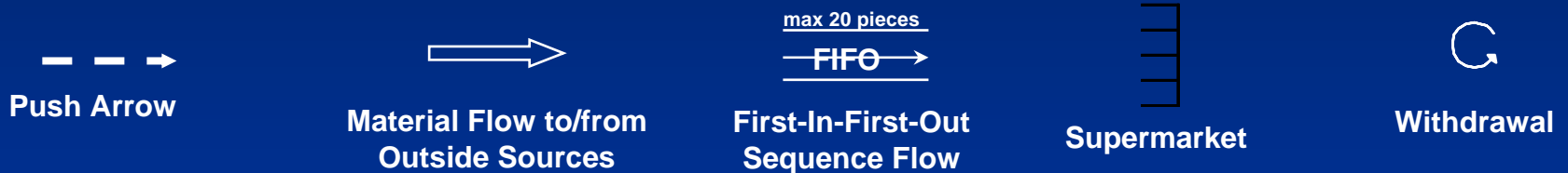
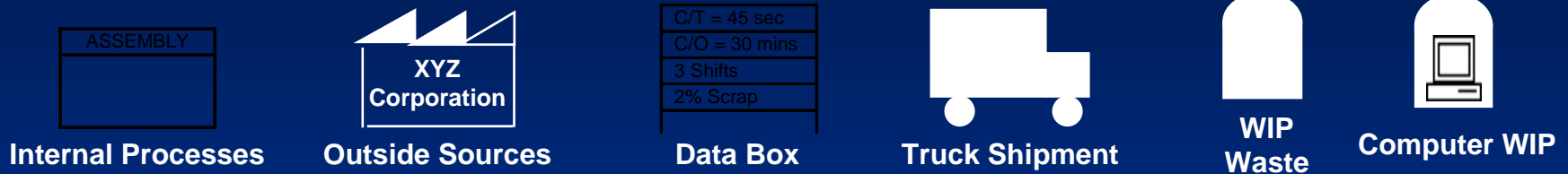
Value Stream Mapping

Current State Map

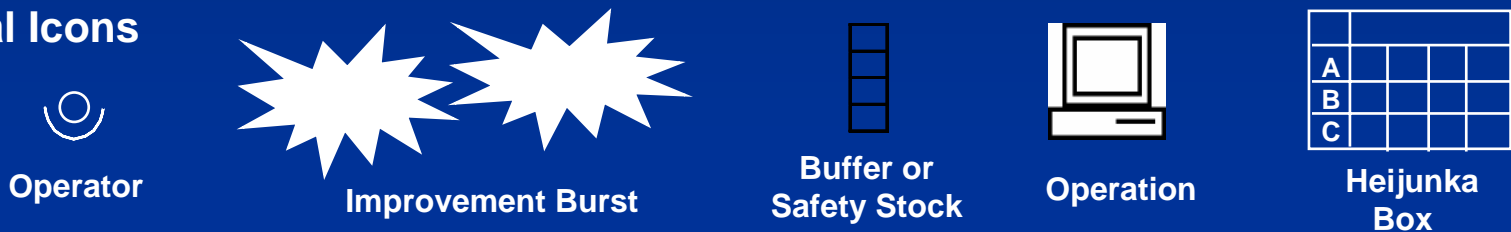
- At minimum, Main or Key processes
- Identify similar processing needs
- Identify process bottlenecks
- Determine work capacity needs
- Analyze needs (Takt time)

Mapping Icons

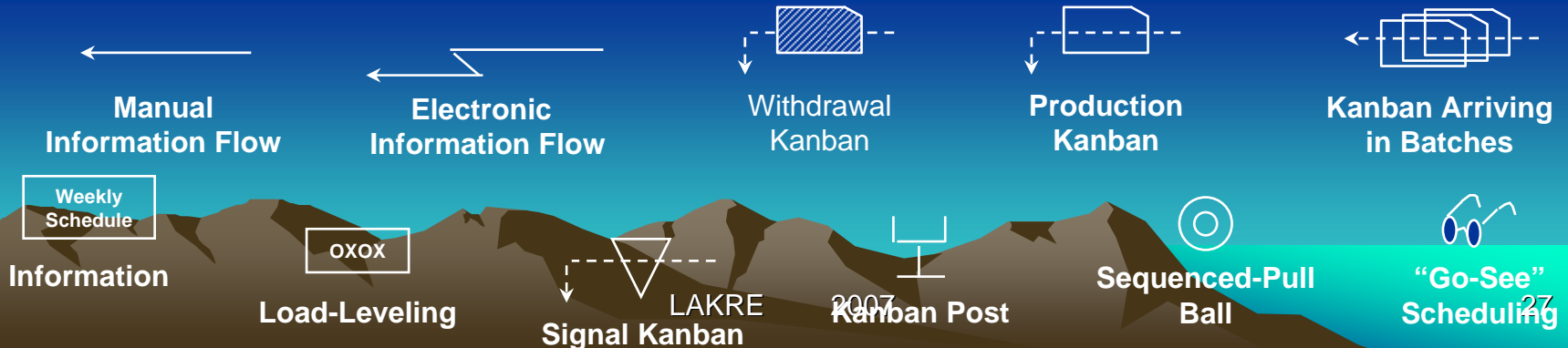
Material Flow Icons



General Icons



Information Flow Icons

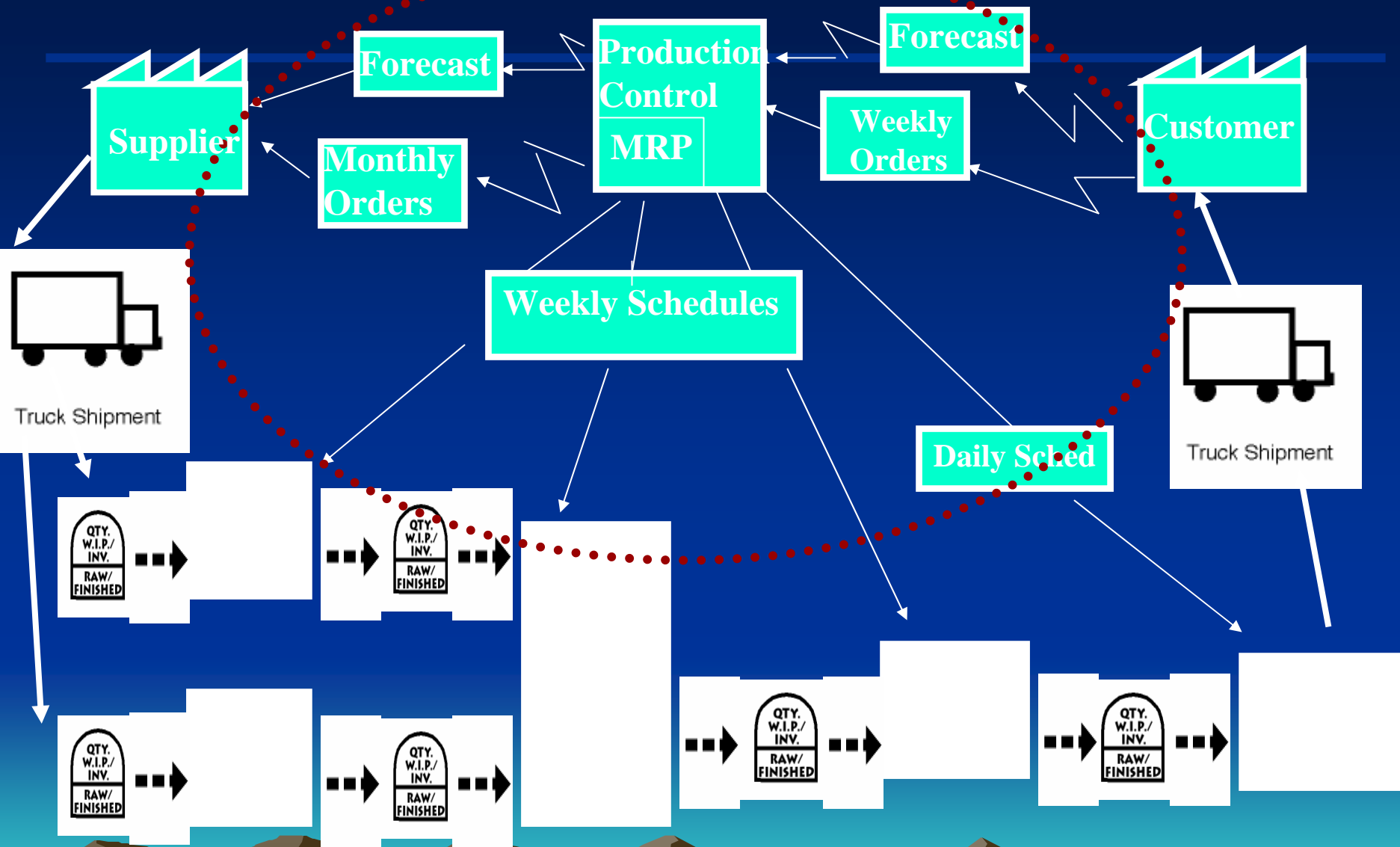


Value Stream Mapping

What do we need to know about the upstream processes?

- Key Process data
 - Data collection box
- Understanding “Work”
 - Requires data collection
 - Understand SEQUENCE of work
 - Understand cycles
 - Capture waiting time

Add the information flow to the Current State



How to Use the Current-State Drawing

- Improve the whole instead of optimizing parts
- See & understand the flow of material and information
 - **STOP** -- Do not go “fix it”
- Envision the “Future State”
 - remove wasted steps,
 - get remaining steps to flow,
 - let the customer pull



Value Stream Mapping

The Future State Map

THE LEAN MANUFACTURING GOAL:

To get each process to make only what the next process needs when it needs it - by linking all processes together by either continuous flow or pull from the customer back to raw material - resulting in the shortest possible lead time, highest quality, and lowest cost.

Mapping the Future-State

Design a lean value stream.

- Don't wait until the current-state map is perfect
- Begin by drawing on the current-state map
- First iteration assume existing product designs, process technologies and plant locations are given
- Future-state should continuously evolve into the ideal state
- Forms foundation for the implementation plan--like a "blueprint"
- Always need a future state and a plan to get there

Key Questions for Future State

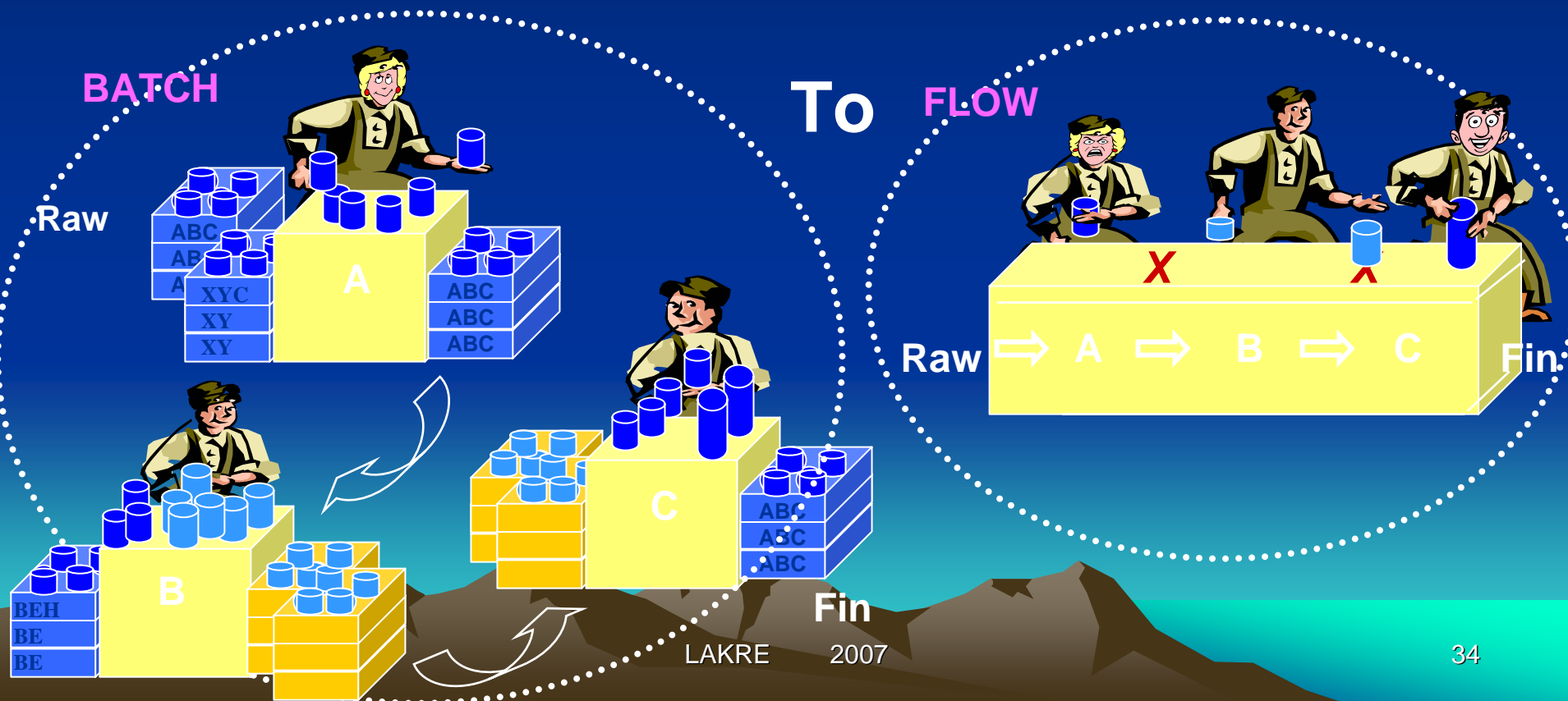
- 1) What are your key performance gaps from both a Customer and Supplier perspective?
- 2) Re-assess your business model – Should you build to stock, assemble to order, or make to order, or in some combination?
- 3) What is your Takt time?
- 4) Where can we continuously flow production?
- 5) Where will you use Supermarket pull systems in order to trigger and control production of upstream processes?
- 6) Where in the production chain will you schedule production(the pacemaker Process)?
- 7) How will you level production at the pacemaker Process?
- 8) What Increment of work will you release and take away from the pacemaker process?
- 9) What process improvements will be necessary to achieve your future state design ie setup reduction, kaizen, increased uptime?

Key Questions for Future State

Where can we continuously flow production?

Continuous flow refers to producing one piece at a time. It is the MOST efficient way to produce.

If the processes are dedicated and the work content can be balanced to Takt time then continuous flow may be possible



Planning to Achieve the Future State

What's the process?

Develop a prioritized implementation plan with measurable goals and timelines. Within each loop strive to:

- develop a continuous flow based on takt time
- establish a pull system to control production
- introduce leveling
- practice kaizen to continually eliminate waste, reduce batch sizes, shrink supermarkets, & extend the range of continuous flow

Planning to Achieve the Future State

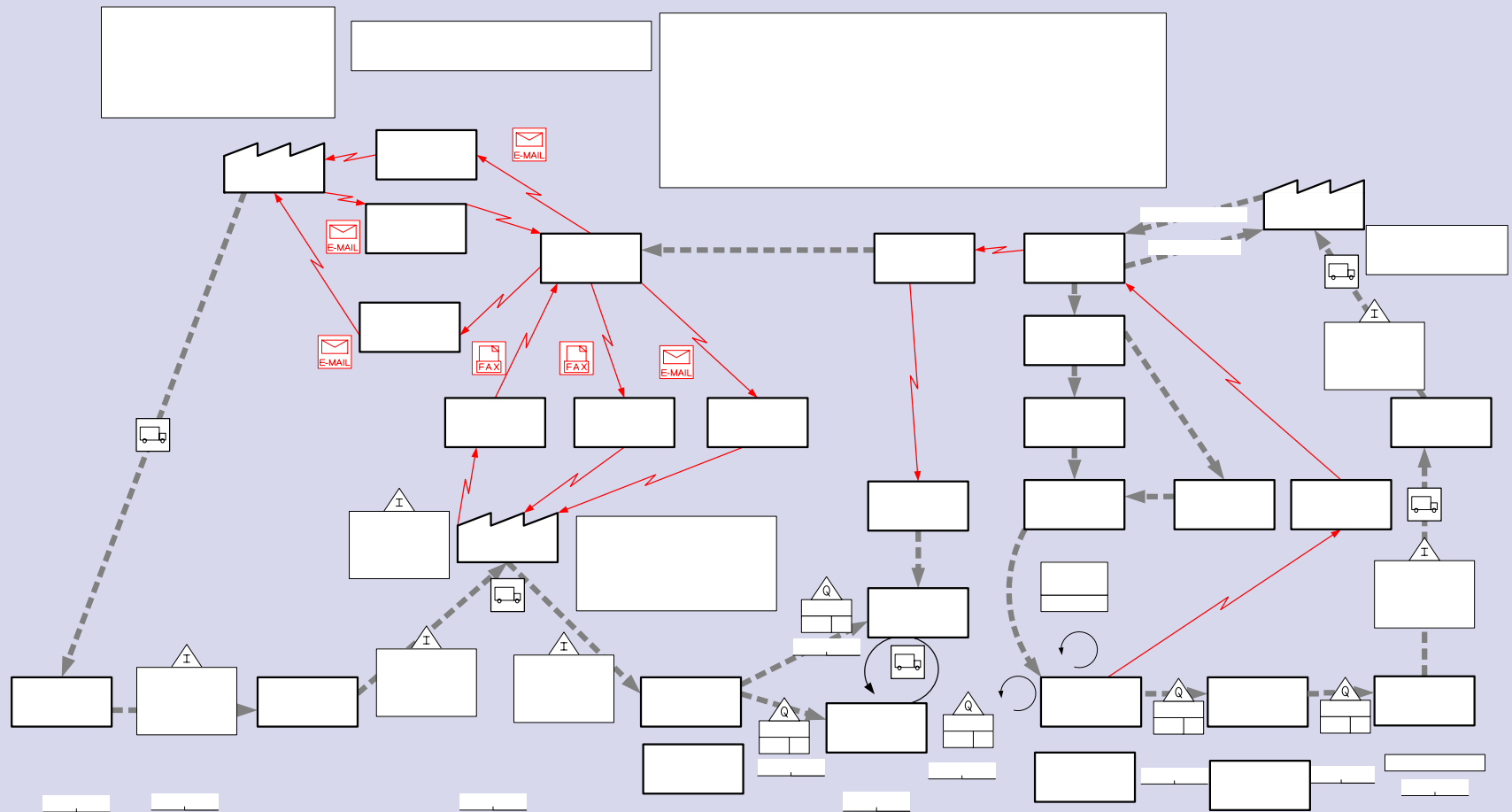
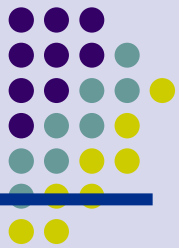
Where do you start?

Divide your value stream map into segments or loops

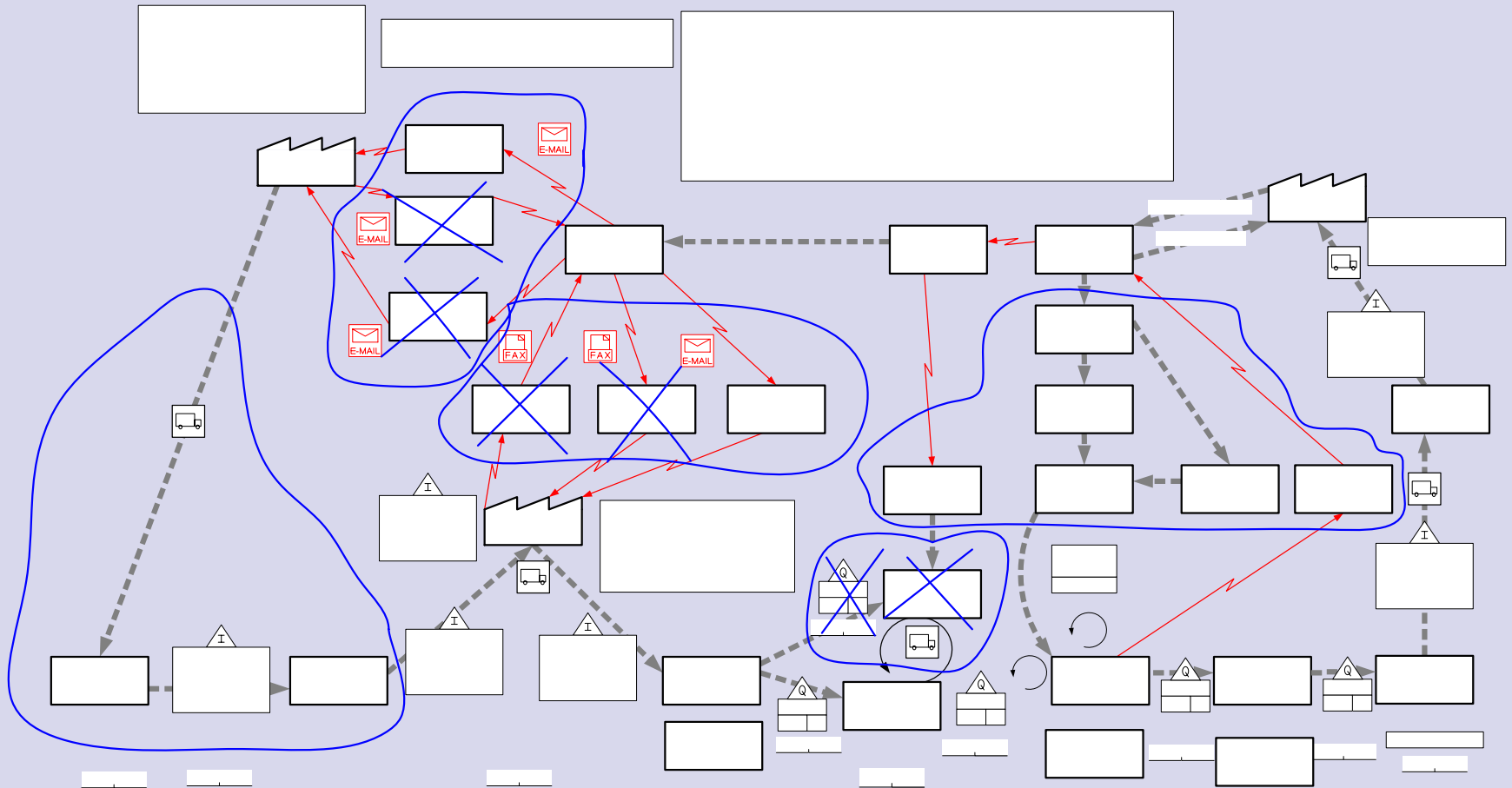
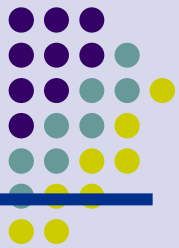
- the pacemaker loop
- the various manufacturing supply loops
- the planning / scheduling loop
- the supplier loop

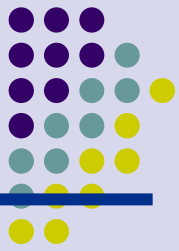
Start with the pacemaker loop, follow with the critical path loop

Current State Value Stream Map

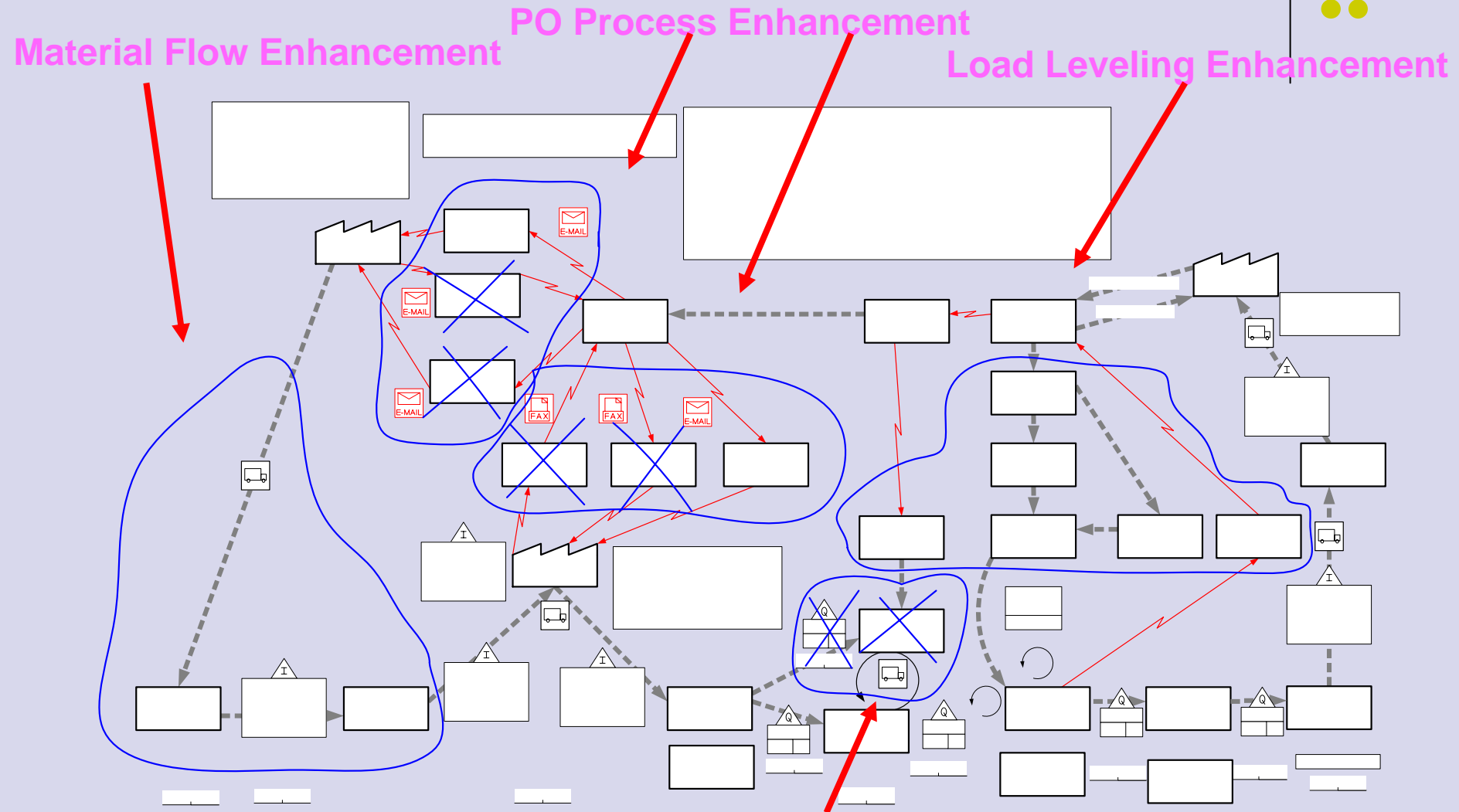


Modified Current State Value Stream Map





Analysis Modified Current State Value Stream Map



Material Inventory Enhancement

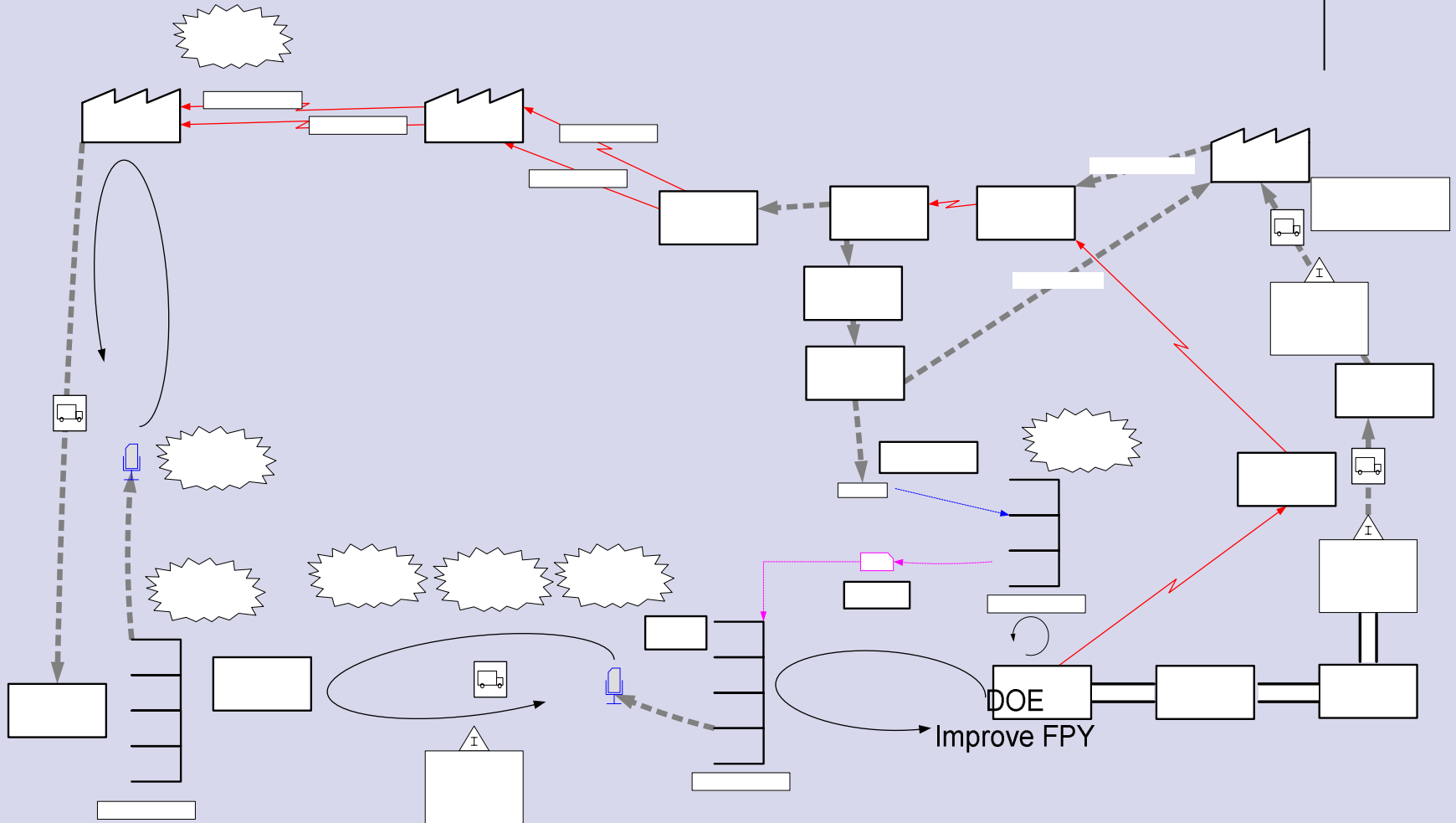
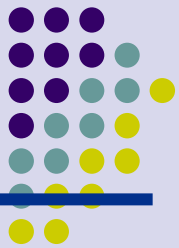
VAKRE 2007

LT=11 weeks

On Time Delivery=0%

On order 2520 PCs

Future State Value Stream Map



Summary

- Production paced to customer demand rate using
 - Balanced work content and linked processes
 - Daily sequential schedules
 - Synchronized flows for subassemblies and components
- Flow/Pull/Perfect
 - Remove barriers to flow
 - Flow line scheduling vs. Work center loading
 - Progressive Improvements vs. “Quick Fix”
- Question the current situation - don't make excuses.
- Question why we do what we do. Is there a better way?
- NOTHING CHANGES, IF NOTHING CHANGES!
- Focus on removing barriers to achieve single piece flow
 - Look for things that cause batching which lead to uncontrolled queues!
- Look at the WHOLE process vs. optimized / “efficient” individual operations

Lean Six Sigma

Any Questions??

A couple of final thoughts -

Insanity is doing the same things over and over again - and expecting different results.

Don't put off until tomorrow what you can do today.

It is not necessary to change. Survival is not mandatory. ***- W. Edwards Deming***