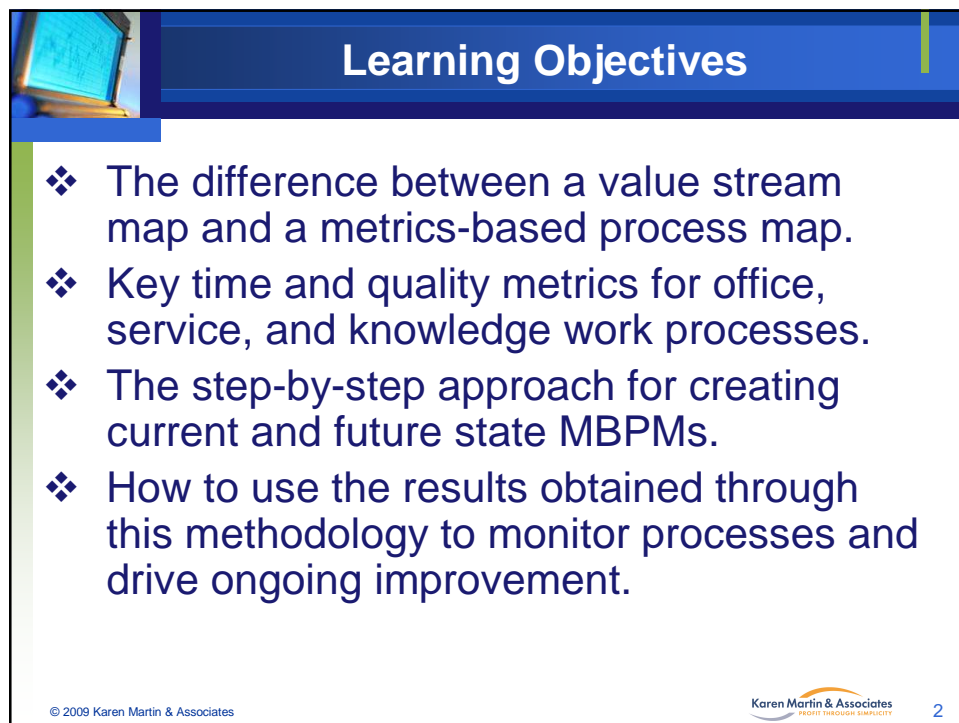




# Metrics-Based Process Mapping (MBPM)

ASQ Lean Six Sigma Conference  
March 2, 2009

**Karen Martin & Associates**  
PROFIT THROUGH SIMPLICITY



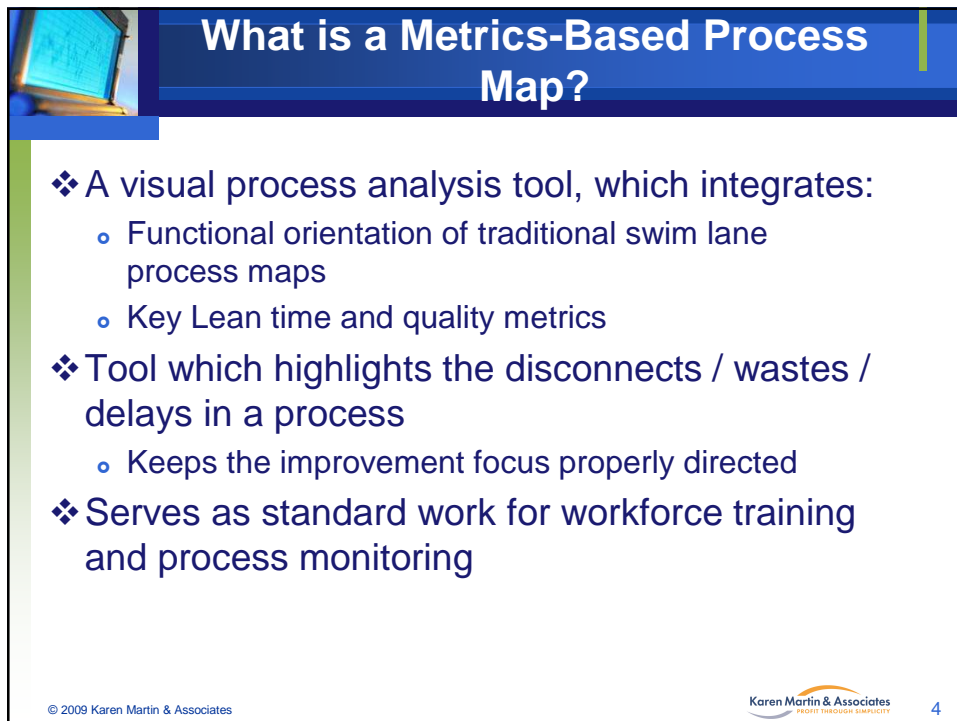
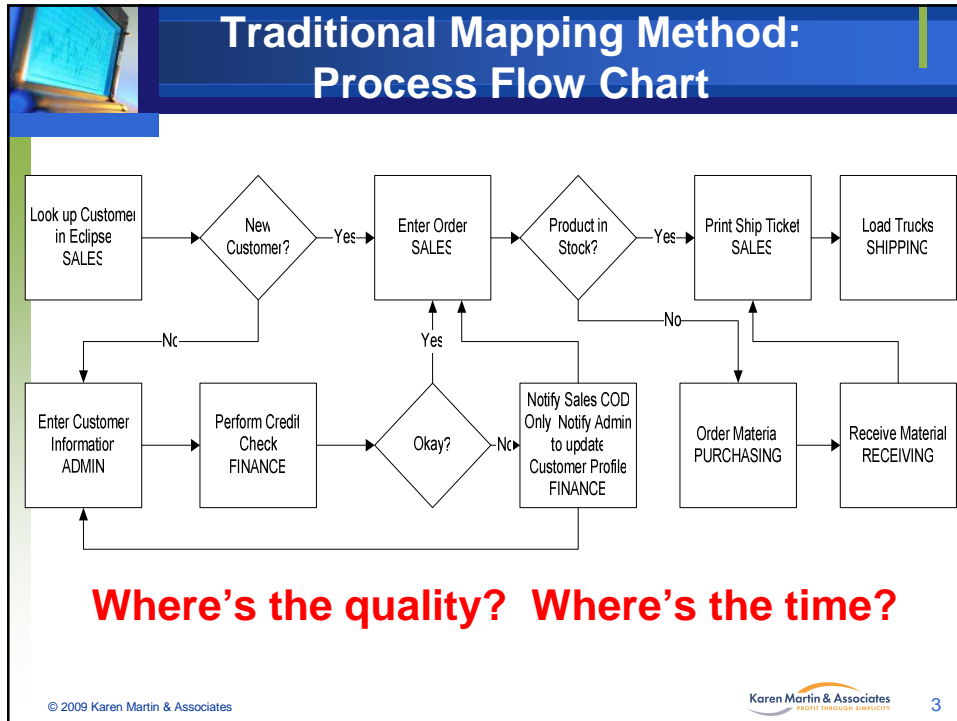
## Learning Objectives

- ❖ The difference between a value stream map and a metrics-based process map.
- ❖ Key time and quality metrics for office, service, and knowledge work processes.
- ❖ The step-by-step approach for creating current and future state MBPMs.
- ❖ How to use the results obtained through this methodology to monitor processes and drive ongoing improvement.

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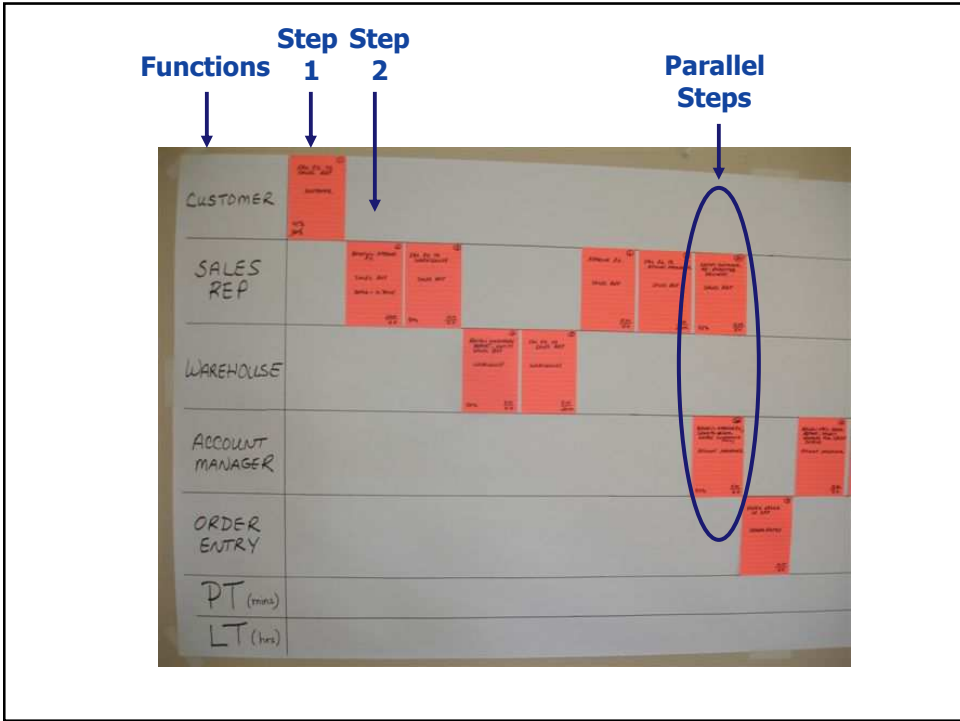
## Metrics-Based Process Mapping (MBPM)



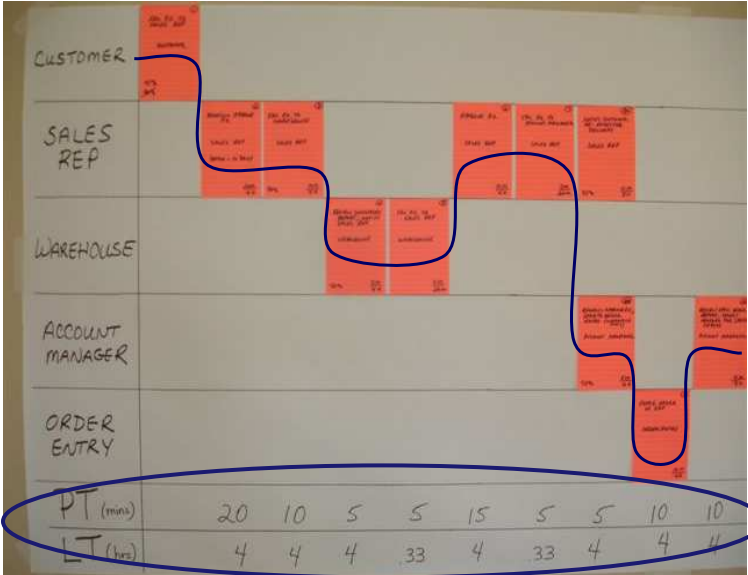
### When Do We MBPM?

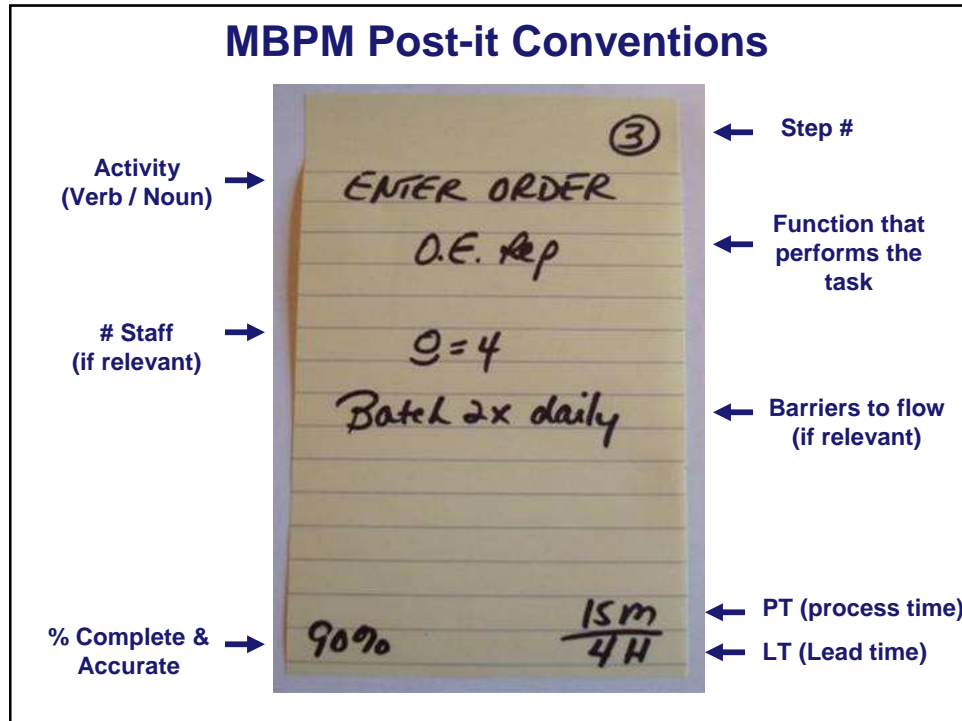
- ❖ Value Stream Driven
  - **VSM** is the *strategic* tool that identifies *when* we need to perform a more detailed analysis of a process
  - **MBPM** is a *tactical* tool used to flesh out the details at each step to see the “waste behind the waste”
    - Enables a team to “drill down” from a few targeted blocks on the VSM
    - Often the first activity in an office-based Kaizen Event

**Metrics-Based Process Mapping  
ASQ Lean Six Sigma 2009**



**Identify Critical Path & Create the Timeline**






## Task-Level Metrics: Time


- ❖ Process time (PT)
  - The time it takes to actually perform the work, if one is able to work on it uninterrupted
  - Includes task-specific doing, talking, and thinking
  - aka “touch time,” work time, cycle time
- ❖ Lead time (LT)
  - The elapsed time from the time work is made available until it's completed **and passed on** to the next person or department in the chain
  - aka throughput time, turnaround time, elapsed time


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## Key Lean Metric: Quality


- ❖ %Complete and Accurate (%C&A)
  - % time downstream customer can perform task without having to “CAC” the incoming work:
    - **C**orrect information or material that was supplied
    - **A**dd information that should have been supplied
    - **C**larify information that should or could have been clear
  - This output metric is measured by the immediate downstream customer and all subsequent downstream customers.

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## Creating the Current State MBPM Phase I

1. Label the map in upper right corner.
  - ❖ Process name, date, facilitator and/or team members
2. List the functions involved in left column.
3. Document all activities/steps.
  - ❖ Verb/noun; concise language; include function as well.
4. Number the activities.
  - ❖ One number per column; concurrent activities are labeled A, B, C, etc.
5. Add activity-specific metrics (PT, LT, %C&A), barriers to flow, and number of staff involved (if relevant).
  - ❖ Include units of measure (mins, hrs, days, etc.)

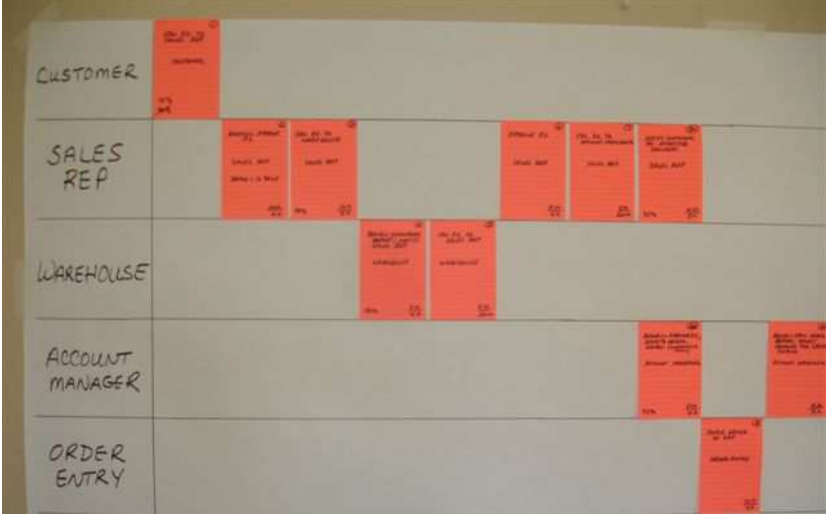
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**Step 2: Create swim lanes for each functional area**




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**Step 3: Document each activity and handoff(s)**  
**Step 4: Number the activities**  
**Step 4: Add key metrics (PT, LT, %C&A) and barriers to flow**



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## %C&A Details

- ❖ Typically obtained via interview
- ❖ Who determines?
  - Immediate downstream customer
  - All subsequent downstream customers who use a party's output in any way
- ❖ Where placed?
  - On the post-it for the person producing the output
- ❖ 0% at a particular step is not rare

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## Creating the Current State MBPM Phase II

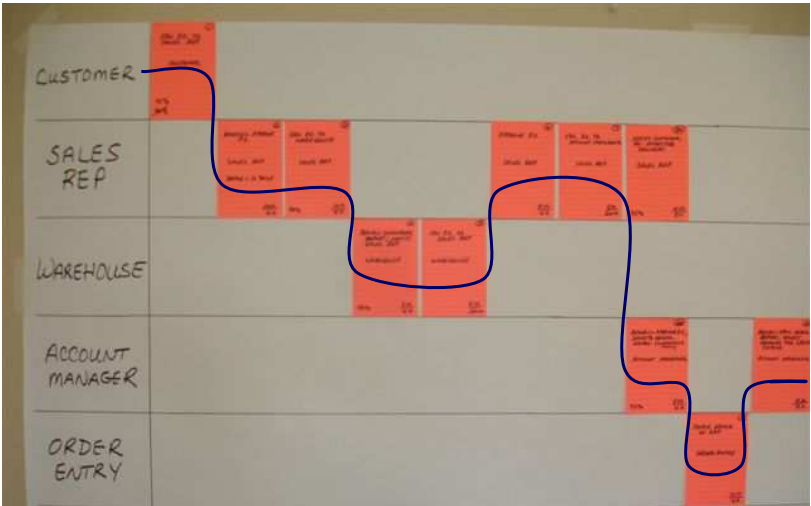
6. Define the critical path.
  - ❖ Longest LT unless "dead-end" step; use colored marker
7. Create the timeline.
8. Calculate the summary metrics
  - ❖ CP PT Sum, CP LT Sum, AR, RFPY, Total PT, Labor Required
9. Identify the value-adding and necessary non-value-adding activities
  - ❖ Use small colored post-it labeled with "VA" and "N."
10. Circle the step-specific metrics that indicate the greatest opportunity for improvement.
  - ❖ Use red marker.
  - ❖ Longest LTs, Low %C&As, High PTs, Low step-specific ARs

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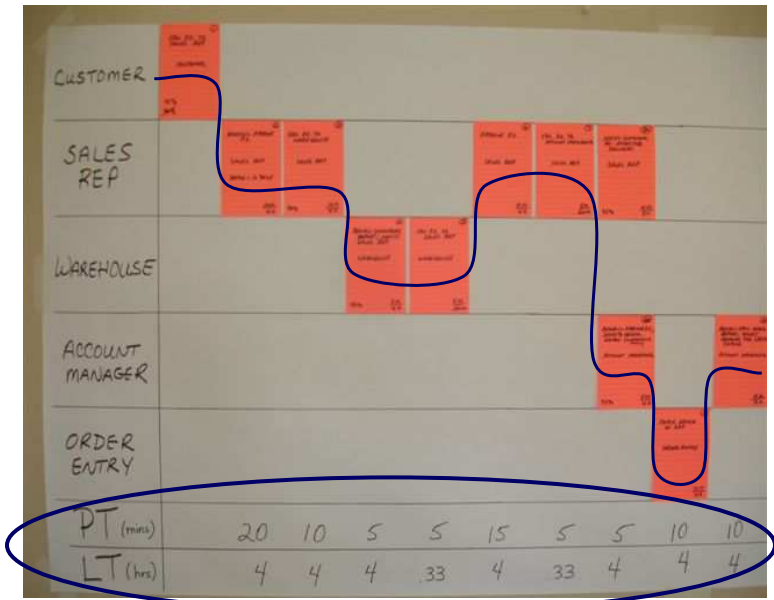



**Step 6: Define the Timeline Critical Path**



**With parallel activities: Chose the longest LT unless a “dead-end” activity**


**Step 7: Create the Timeline**






### Step 8: Calculate Summary Metrics - Time


- ❖ Critical Path PT Sum (CP PT)
- ❖ Critical Path LT Sum (CP LT)
- ❖ Activity Ratio (AR)
  - The percentage of time work is being done to the patient/item/data passing through the process
  - $AR = (CP\ PT\ Sum \div CP\ LT\ Sum) \times 100$ 
    - Expressed as a percentage
  - $100 - AR = \% \text{ of time product is idle}$

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### Step 8 (continued): Calculate Summary Metrics - Quality

- ❖ Rolled First Pass Yield (RFPY) =
  - Product of all %C&A's
  - The percentage of "items" (material, information, or people) that pass through the entire process with no rework required
  - Process check: The RFPY will always be lower than the lowest %C&A.

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**Step 8 (continued):  
Calculate Summary Metrics - Labor Requirements**

$$\# \text{ FTES}^* = \frac{\text{Total PT}^{**} \text{ (in hrs)} \times \# \text{ occurrences/year}}{\text{Available work hrs/year/employee}}$$


$$\text{Freed Capacity} = \text{CS FTEs} - \text{FS FTEs}$$

\* FTE = Full-time Equivalent (2 half time employees = 1 FTE)

\*\* Total PT = Sum of *all* activities' PTs, not just critical path

**Step 8 (continued):  
Document Results**

Metric	Current State	Projected Future State	Projected % Improvement
CP PT			
CP LT			
AR			
RFPY			
Total PT			
Labor requirements			
Freed capacity	_____		_____

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**Step 9: Label the value-adding (VA) and necessary non-value adding (N) activities**


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**Step 10: Circle the data that indicates the greatest need for improvement**

## Typical Current State Findings


Islands of value-adding activities  
All other time is “waste.”

Future State Design: How can we progress from one “VA” or “N” step to the next and eliminate all waste?

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## Future State Design

- ❖ Goals
  - Reduce overall LT
  - Improve RFPY
  - Reduce overall PT
  - Improve LT, PT, and %C&A at individual steps
- ❖ How?
  - Eliminate NVA steps
  - Minimize handoffs
  - Eliminate rework
  - Reduce batching
  - Eliminate unnecessary IT
  - Reduce WIP

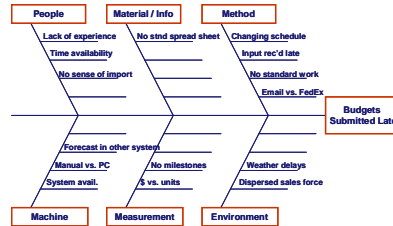
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## Root Cause Analysis 4 Key Tools

### 5 Why's

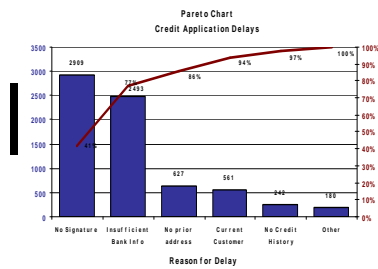
Why?  
Why?  
Why?  
Why?  
Why?

### Cause-and-Effect Diagram

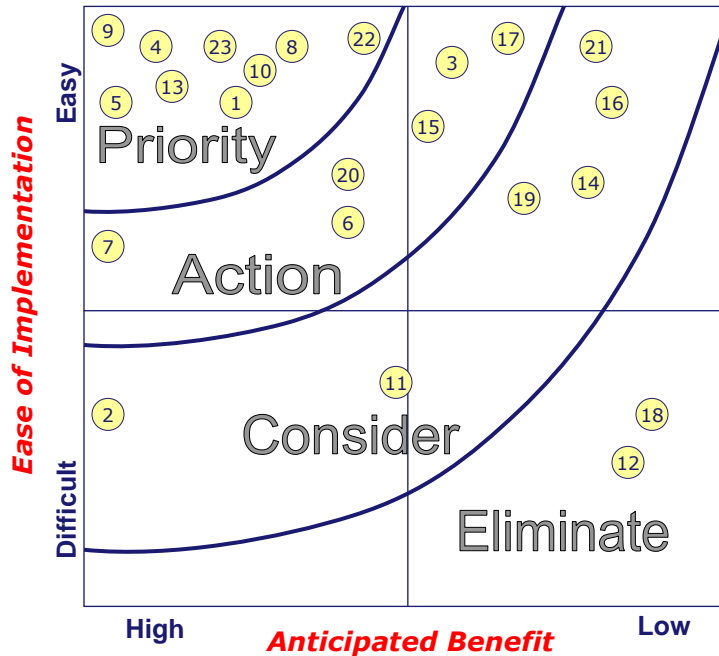


Check Sheets Quantify Occurrences

Reason	Tally
Material shortage	
Quality issue requiring rework	
Staffing/absenteeism	
Order entry error	
Changing customer requirements w/ no adjustment to expected delivery	
Equipment failure	



## PACE Prioritization Matrix



## Step 8 (continued): Document Results

Metric	Current State	Projected Future State	Projected % Improvement
CP PT			
CP LT			
AR			
RFPY			
Total PT			
Labor requirements			
Freed capacity	_____		_____

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## Electronic Documentation?

- ❖ Archive the team's work
- ❖ Distribute the maps to remote locations
- ❖ Document the new standard work for the process
  - Training/retraining staff
  - Monitoring process performance
- ❖ Communicate the impact of Kaizen Events and other improvement activities

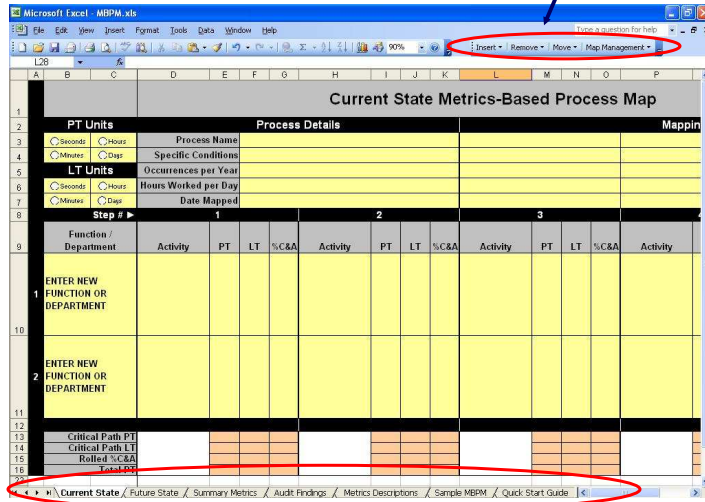
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# Metrics-Based Process Mapping ASQ Lean Six Sigma 2009

## Excel-Based Option

Custom toolbar with pull-down menus

- Seven sheets
- Current State
- Future State
- Summary Metrics
- Audit Findings
- Metrics Descriptions
- Sample MBPM
- Quick Start Guide



**Functions**

**Process Steps**

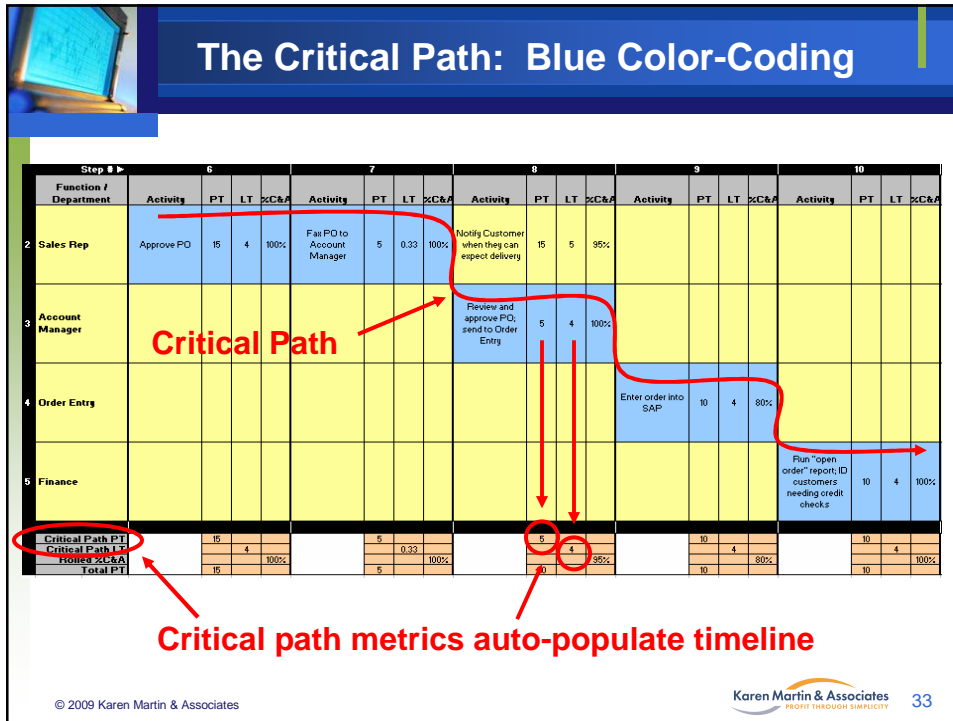
**Key Metrics & Timeline**

Blue color-coded cells indicate the critical path

Current State Metrics-Based Process Map																	
PT Units		Process Details										Mapping Team					
<input type="radio"/> Seconds	<input type="radio"/> Hours	Process Name		Order Fulfillment								Diane O'Shea		Ryan Austin			
<input type="radio"/> Minutes	<input type="radio"/> Days	Specific Conditions		Domestic orders through sales force								Sean Michaels		Mely Townsend			
LT Units		Occurrences per Year															
<input type="radio"/> Seconds	<input type="radio"/> Hours	37,000															
<input type="radio"/> Minutes	<input type="radio"/> Days	Hours Worked per Day															
		Date Mapped		25-Jun-08													
		Facilitator		Diane Morgan													
Step #	Function / Department	Activity	PT	LT	%C&A	Activity	PT	LT	%C&A	Activity	PT	LT	%C&A	Activity	PT	LT	%C&A
1	Customer	Fax PO to Sales Rep	0	0	45%												
2	Sales Rep					Review PO; clarify with customer as needed	20	2	90%	Fax PO to warehouse	10	4	90%				
3	Finance																
4	Warehouse / Shipping					Check inventory levels; notify Sales Rep re status	5	4	90%	Fax PO to Sales Rep	5	0.33	90%				
Critical Path PT			0			20				10				5			
Critical Path LT			0	0	45%	2		4	90%	4		0.33	90%				
Rolled %C&A			0		45%	2		4	90%	4		0.33	90%				
Total PT			0			20				10				5			



# Metrics-Based Process Mapping ASQ Lean Six Sigma 2009



### Summary Metrics

Metric	Current State		Projected Future State		Desired Direction		Projected Improvement
	Value	Units	Value	Units	Up	Down	
Critical Path PT Sum	140.0	minutes	45.0	minutes		⊕	67.9%
Critical Path LT Sum	38.7	hours	14.2	hours		⊕	63.3%
Activity Ratio	6.0	%	5.3	%	⊕		-11.7%
Rolled First Pass Yield	21.4	%	75.3	%	⊕		251.9%
# of Activities	16	activities	8	activities		⊕	50.0%


Metric	Current State		Projected Future State		Projected Change
	Value	Units	Value	Units	
Sum of Total PTs	155.0	minutes	45.0	minutes	-71.0%
Occurrences per Year	37500	occurrences	37500	occurrences	0.0%
Available Work Hours per Year	1950	hours	1950	hours	0.0%
Labor Requirements	49.7	FTEs	14.4	FTEs	-71.0%

Metric	Current State		Projected Future State		Desired Direction		Projected Improvement
	Value	Units	Value	Units	Up	Down	
Number of reviews & approvals	4.0	reviews	1.0	review	○	⊕	75.0%

❖ **Auto-Calculates:**

- Summary time and quality metrics for before and after maps
- Projected % improvement (color-coded for visual ease)
- Staffing requirements
- User-defined metrics




## MBPM Tips

- ❖ 10 people max per team; use same people for both current and future state
- ❖ Documenting the current state takes 1/3 to double the time of the future state design phase
- ❖ Avoid gaps between current and future state mapping
- ❖ Typical teams need 5-10 blocks to truly understand what you're asking in terms of the metrics
- ❖ Can "chunk" metrics if needed
- ❖ Use a skilled, impartial facilitator

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## Learning Objectives

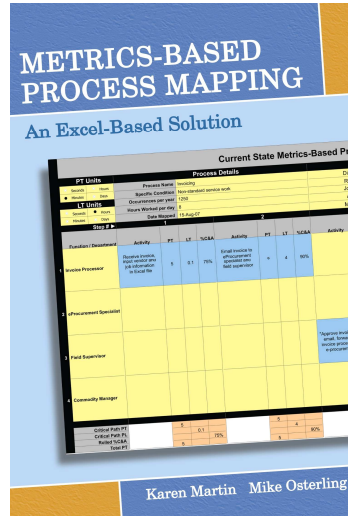
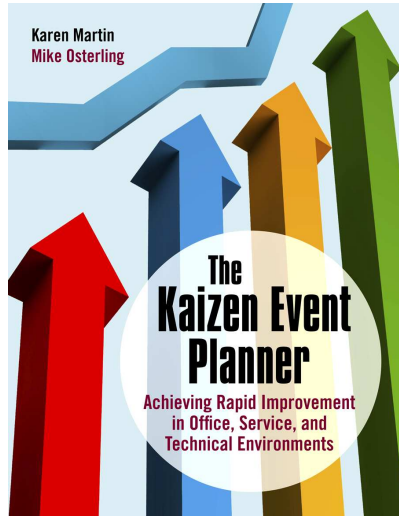
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## MBPM Resources



## Additional Questions?



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