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NPTEL ONLINE
CERTIFICATION COURSE

Project Management for Managers

Lec – 58 Six Sigma Tools

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Analytical Tools for Six Sigma and Continuous Improvement: Checksheet

Can be used to keep track of defects or used to make sure people collect data in a correct manner

Monday

Billing Errors

Wrong Account

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Operator Errors

Wrong Account

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Wrong Amount

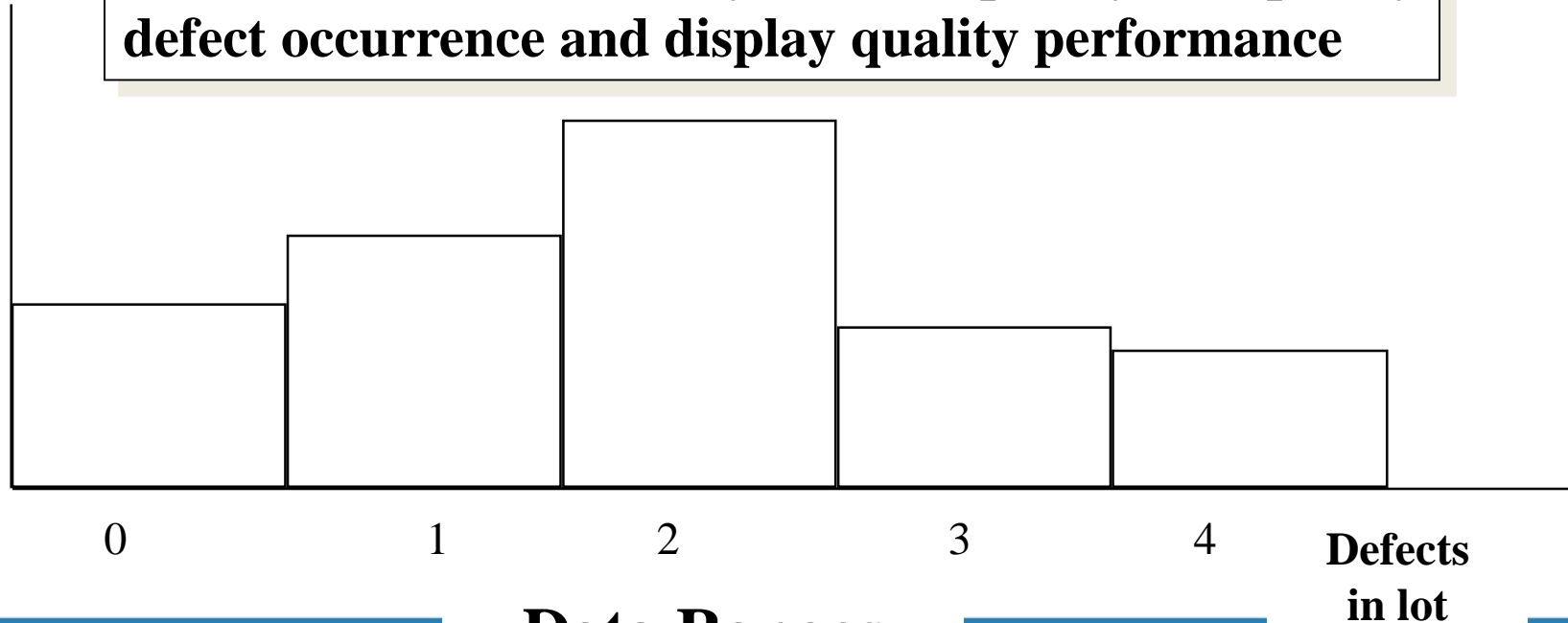
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Analytical Tools for Six Sigma and Continuous Improvement: Histogram

Number of Lots

Can be used to identify the frequency of quality defect occurrence and display quality performance



Data Ranges



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Analytical Tools for Six Sigma and Continuous Improvement: Cause & Effect Diagram

Possible causes:

Machine

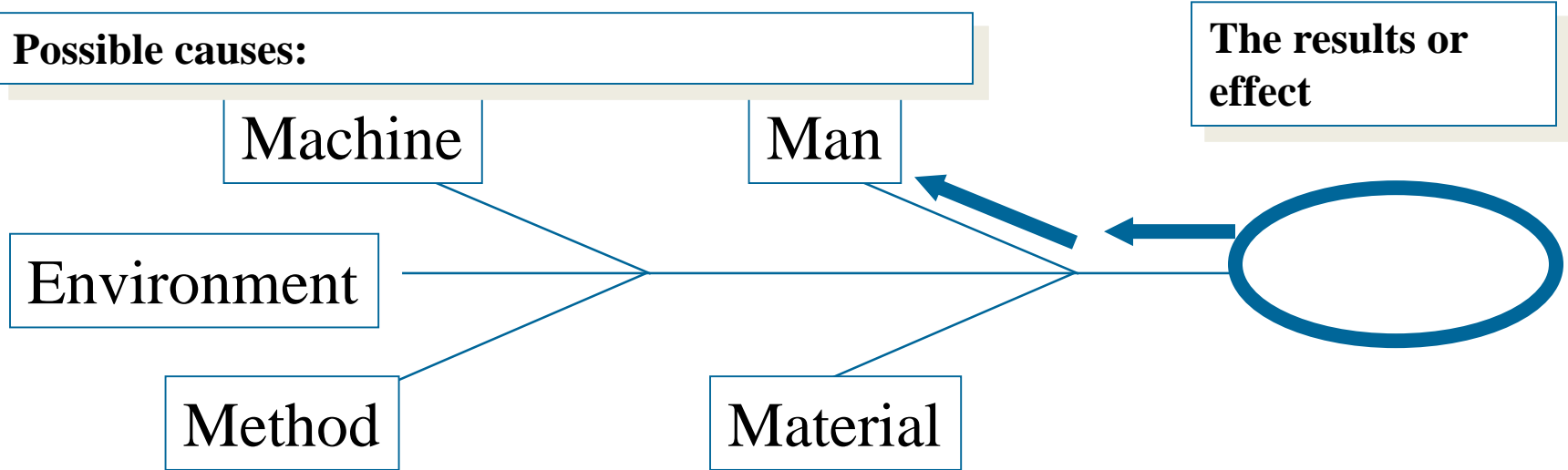
Man

Environment

Method

Material

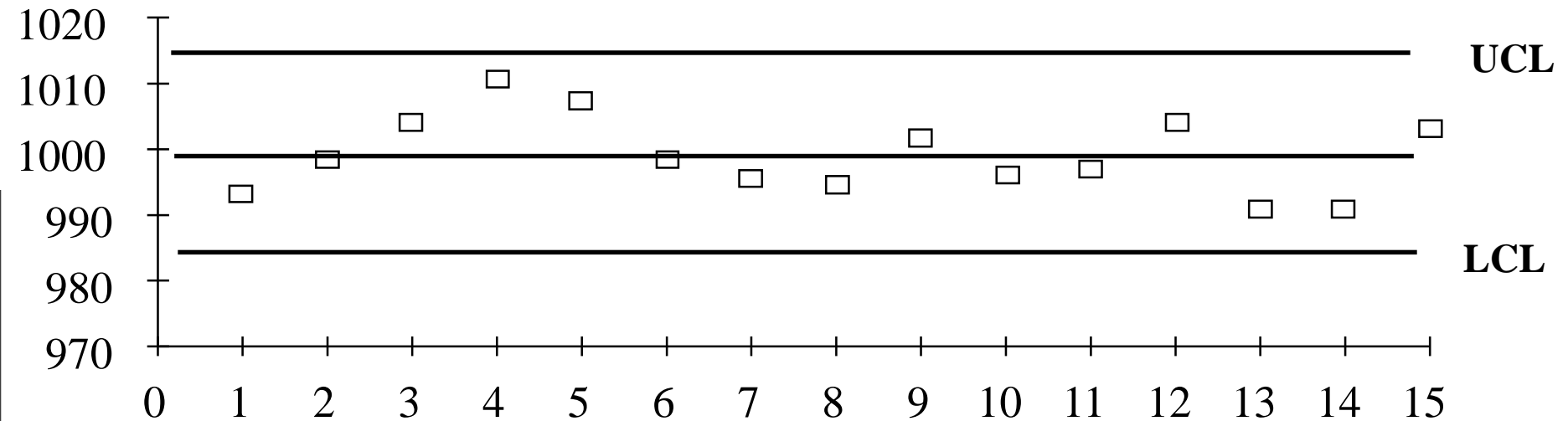
The results or effect



Can be used to systematically track backwards to find a possible cause of a quality problem (or effect)

Analytical Tools for Six Sigma and Continuous Improvement: Control Charts

Can be used to monitor ongoing production process quality and quality conformance to stated standards of quality



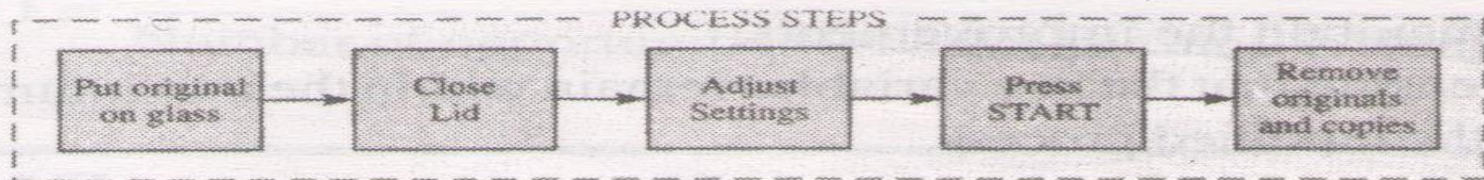
Other Six Sigma Tools

- **Opportunity Flow Diagram** used to graphically show those activities that add value from those that are performed (and maybe could be reduced or removed) that do not add value to the finished product
- **Failure Mode and Effect Analysis (FMEA)** is a structured approach to identify, estimate, prioritize, and evaluate risk of possible failures at each stage in the process
- **Design of Experiments (DOE)** a statistical test to determine cause-and-effect relationships between process variables and output

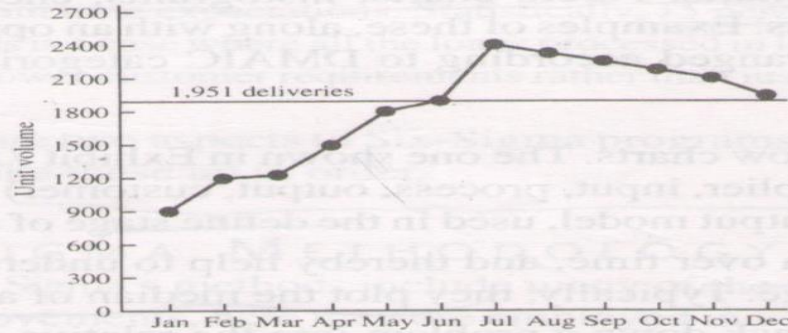


Flow Chart of Major Steps in a Process*

SUPPLIERS	INPUTS	PROCESSES	OUTPUTS	CUSTOMERS
Manufacturer	Copier	Making a Photocopy	Copies	You
Office Supply Company	Paper			File
	Toner			Others
Yourself	Original			
Power Company	Electricity			



Run Chart**
Average monthly volume of deliveries
(per shop)



DATA COLLECTION FORMS*

Checksheets are basic forms that help standardize data collection by providing specific spaces where people should record data.

Defines what data are being collected → **Machine Downtime (Line 13)**

Operator: Wendy Date: May 19

Reason	Frequency	Comments
Carton Transport	### ##	
Metal Check	###	
No Product	###	
Sealing Unit	##	
Barcoding	###	
Conveyor Belt		
Bad Product	###	Burned flakes ### Low weight ##
Other	##	

Lists the characteristics or conditions of interest

Includes place to put the data

May want to add space for tracking stratification factors

Has room for comments

Measure

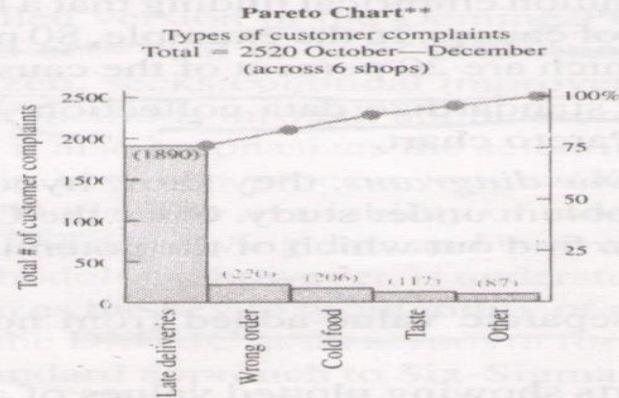
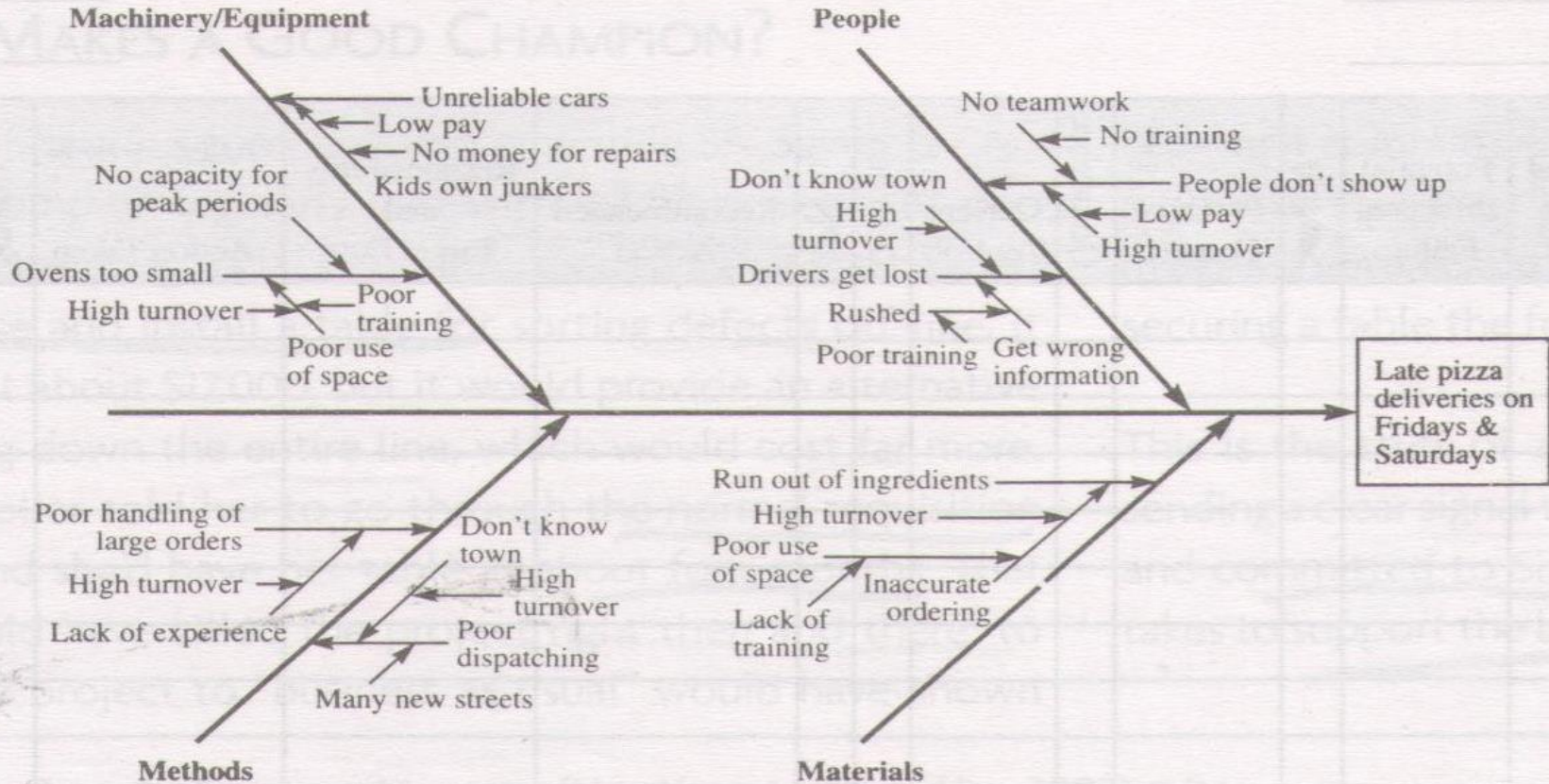


Illustration note: Delivery time was defined by the total time from when the order was placed to when the customer received it.



C & E/Fishbone Diagram**
Reasons for late pizza deliveries

Analyze



Opportunity Flow Diagram*

Organized to separate value-added steps from non-value-added steps.

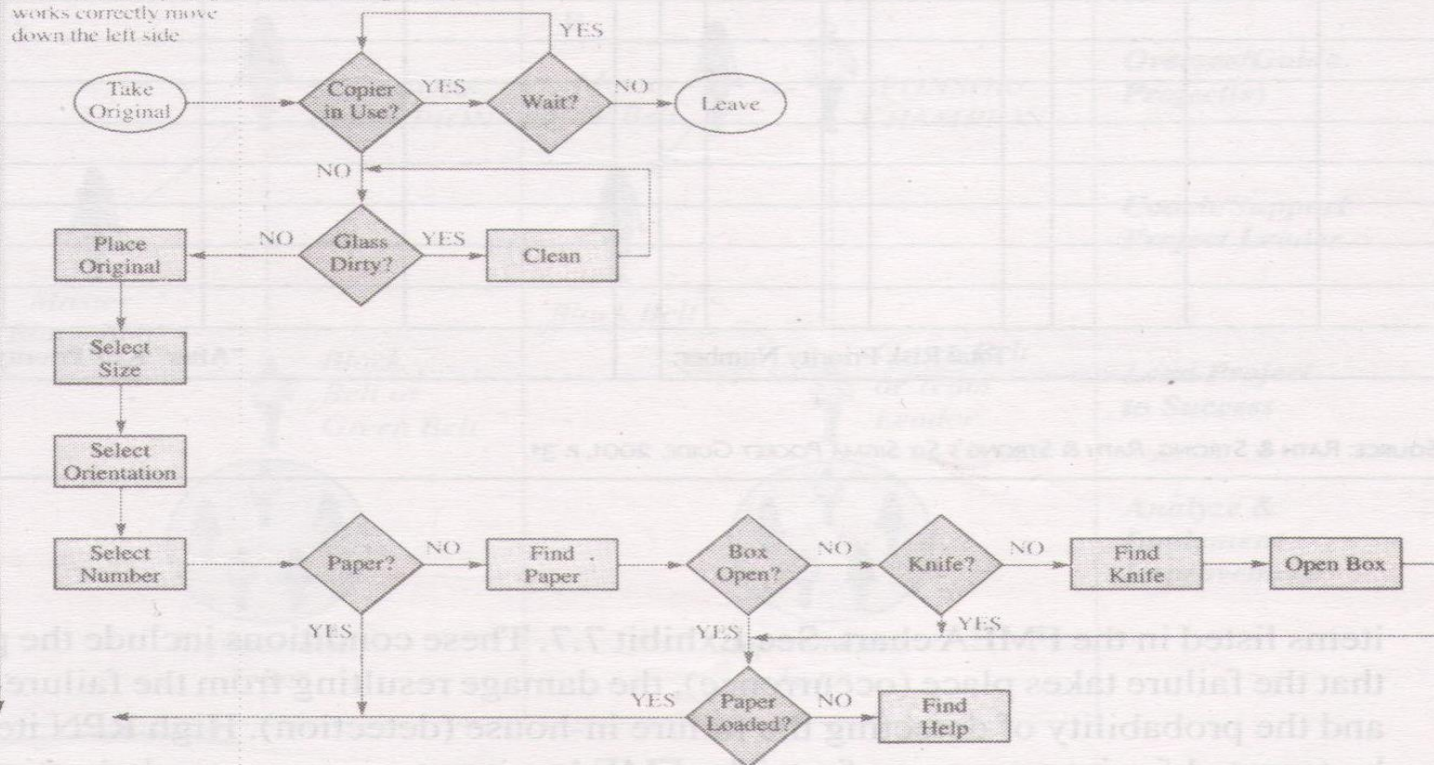
Value-Added

Steps that are essential even when everything works correctly move down the left side

Non-Value-Added

Steps that would not be needed if everything worked right the first time move horizontally across the right side

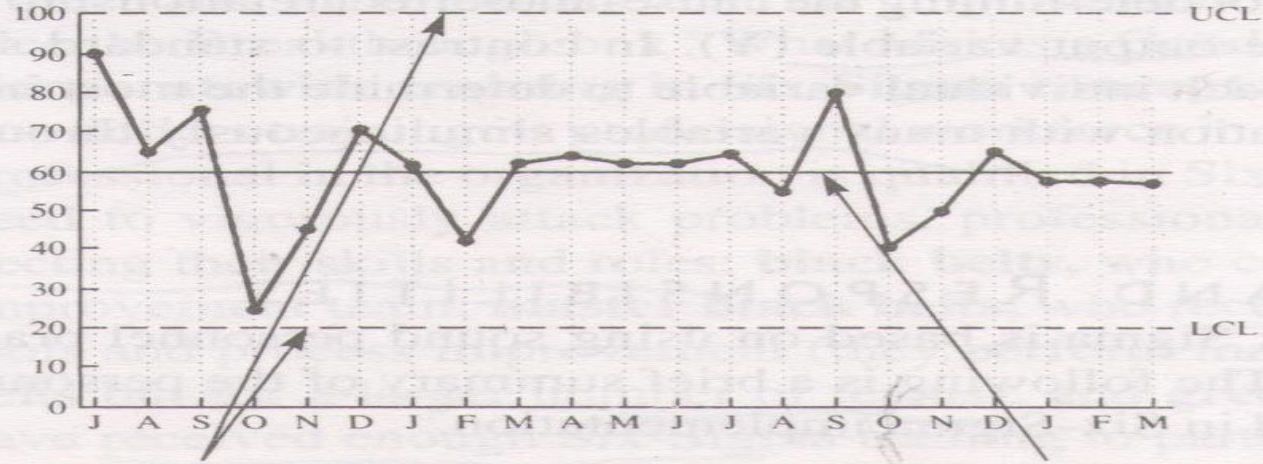
Improve



Control Chart Features*

Basic features same as a time plot

Control



Control limits (calculated from data) added to plot

Centerline usually average instead of median



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Six Sigma Roles and Responsibilities

- 1.Executive leaders must champion the process of improvement: Executives and managers**
- 2.Corporation-wide training in Six Sigma concepts and tools**

Black belt: who coach or leads SS improvement team

Master black belt: Who receive in depth training on statistical tools process improvement(larger teams)



Green belt: who have received enough SS training to participate in a team or, in some companies, to work individually on a small scale project related to their own jobs.

3.Setting stretch objectives for improvement

4. Continuous reinforcement and rewards



The Shingo System: Fail-Safe Design

- **Shingo's argument:(Successive, self, source checks)**
 - SQC methods do not prevent defects
 - Defects arise when people make errors
 - Defects can be prevented by providing workers with feedback on errors
 - SMED – to cut set up time
- **Poka-Yoke includes:**
 - Checklists
 - Special tooling that prevents workers from making errors



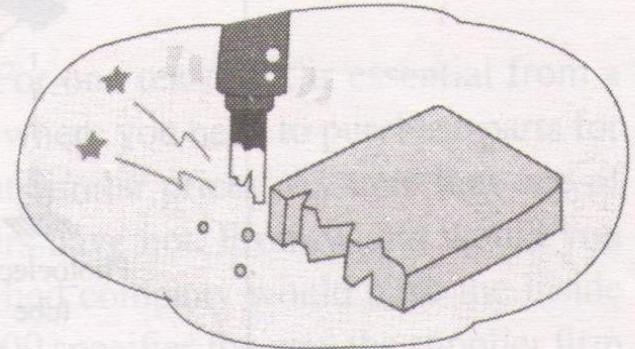
What Are the Sources of Defects?

There are various types of defects. In order of importance these are

1. Omitted processing
2. Processing errors
3. Errors setting up workpieces
4. Missing parts
5. Wrong parts
6. Processing wrong workpiece
7. Misoperation
8. Adjustment error
9. Equipment not set up properly
10. Tools and jigs improperly prepared

What are the connections between these defects and the mistakes people make?

☆ Causal connections between defects and human errors



☐ Strongly connected ☐ Connected

CAUSES OF DEFECTS \ HUMAN ERRORS	INTENTIONAL	MIS-UNDERSTANDING	FORGETFUL	MIS-IDENTIFICATION	AMATEURS	WILLFULL	INADVERTENT	SLOWNESS	NON-SUPERVISION	SURPRISE
Omitted processing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Processing errors	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Errors setting up workpieces	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Missing parts	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		<input type="radio"/>	
Wrong parts	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		<input type="radio"/>	
Processing wrong workpiece	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		<input type="radio"/>	
Misoperation			<input type="radio"/>				<input type="radio"/>		<input type="radio"/>	<input type="radio"/>
Adjustment error	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Improper equipment setup			<input type="radio"/>				<input type="radio"/>			<input type="radio"/>
Improper tools and jigs			<input type="radio"/>				<input type="radio"/>			<input type="radio"/>

SOURCE: N. K. SHIMBUN, LTD./FACTORY MAGAZINE (ED.), *POKA-YOKE: IMPROVING PRODUCT QUALITY BY PREVENTING DEFECTS* (CAMBRIDGE, MA: PRODUCTIVITY PRESS, 1989), P. 14. FROM *POKA-YOKE: IMPROVING PRODUCT QUALITY BY PREVENTING DEFECTS*, EDITED BY NKS/FACTORY MAGAZINE. COPYRIGHT © 1987 PRODUCTIVITY, INC, PO BOX 13390, PORTLAND, OR 97213. 800-394-6868.

