

Productivity Improvement

:

Productivity is NOT ...

- Productivity is not equivalent to production .1
- Productivity is not a mere pursuit of efficiency .2
- Input factor
Work Smarter Not Harder
Productivity is not equivalent to productive capacity .3
- .Rejected by customers
Productivity is not equivalent to profitability .4

Productivity: A Measure of ... :

+ =

Productivity = Efficiency + Effectiveness

=

Efficiency = Doing things right

=

Effectiveness = Doing the right things

+

=

Productivity = Doing things right + Doing the right things

Efficiency

The Ratio of Actual Output Attained to Standard Output Expected



Effectiveness

The degree of accomplishment of objectives

:

.1

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.6

PRODUCTIVITY MEASUREMENT

If You Cannot Measure Productivity, You Cannot Manage It.

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Partial Productivity (

:

Total Output/ (1) Input ÷ = PP

:

:Labour Productivity .1

:Material Productivity .2

:Machine Productivity .3



:Capital Productivity .4

:Multi-factor Productivity (

—
Total Output/ 1 Input + 2 Input ÷ =MFP
(Benchmarking)

Total Factor Productivity (TFP) (

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÷ =TFP
Total Output/ (1 Input + 2 Input + 3 Input)

: Productivity Analysis

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:Productivity Evaluation

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:Productivity Planning

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:Productivity Improvement

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-

:Ways of Improving Productivity

:

Achieving the same output from less input

•

Achieving more output for the same input

•

Achieving much more output for slightly more input

•

Getting slightly less output for much less input

•

Achieving more output from less input

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(

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|---------------------------|---|------------------|
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| | : | .12 |
| | : | .13 |
| | : | .14 |
| | : | .15 |
| | : | .16 |
| () | : | .17 |
| | : | .18 |
| | : | .19 |
| | : | .20 |
| | : | .21 |
| | : | .22 |
| | : | .23 |
| | | Breakdown |
| Capacity Utilization Rate | | .24 |
| Labor Utilization Rate | | .25 |
| | : | .26 |



"First- in, first- out"

Just-in-time Inventory System –

Idle Time

Economic Order

Quantity

Plant Layout Design



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.1
.2
.3
.4
.5
.6

.7
.8
.9
.10
.11
.12
.13
.14

Types of Layout

:

Fixed Position Layout .1

...

Product Layout .2



:Process Layout .2

:Hybrid Layout .3

(Product-Process Layout Design

:Modular Layout Design .4

Modules

:Cellular Layout .5

Group Technology

Efficiency

Flexibility

Material Handling



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|---------------------------|----|
| : | - |
| | - |
| | - |
| | - |
| | - |
| "Space is money" | - |
| | - |
| | - |
| | - |
| stow | - |
| | - |
| Work in process | - |
| Higher inventory turnover | - |
| | - |
| : | |
| | .1 |
| | .2 |
| | .3 |
| | .4 |

Line Balancing

(Work Station)



.Slack Time ()

Bottleneck

(Cycle Time)

.(Bottleneck)

:

Backlog

.1
Bottleneck

.2

.3

.4

.5

.6

.7

.8

.9

Work Study

:

.1

()

.2



Unproductive Time

Idle Time

()

Method Study

.1

Work Element

:

- (a)
- (b)
- (c)
- (d)
- (e)

Method Study Steps

:

Select the work to be studied :

:

Record

Critical Examination :

:Develop

.1

.2



.3

.4

Define :

:

Install :

:

-

Standard Practice

Maintain :

:

TIME AND MOTION STUDY

MOTION STUDY

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:

.1

.2

Foreman

.3

TIME STUDY

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(Work Measurement

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(

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Elements
)
 .Work Element (Analysis Phase -
 Measurement Phase -
 Synthesis -

()
 Standard Time -

Methods Alternative •
 Planning •
 Manning •
 Scheduling and balancing •

- •
 •
 •
 •
 •
 •

Time Study Steps :



$$T_s = T_n \left(1 + \frac{A}{100} \right)$$

:Standard Time

$$T_s = T_n \times \left(1 + \frac{A}{100} \right)$$

$$T_s = T_n (1 + \frac{A}{100})$$

Ergonomics

Interacts

$$T_s = T_n \left(1 + \frac{A}{100} \right)$$



Common Risk Factors

- Awkward Position -
- Repetitiveness -
- Sustained Exertions -
- Extreme temperatures and hand-arm vibration -
- Poorly fitted gloves -

Continuous repetition of the same motions

" Carpal tunnel syndrome

.Eyestrain

Keyboard

Total Quality Management

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) (

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(

.Total Quality Control

"Total Quality Management (TQM)

1985



People Focus

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- .1
- .2
- .3
- .4
- .5
- .6
- .7
- .8
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- .13
- .14
- .15
- .16
- .17
- .18
- .19



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|-----------|--------------------------|-----|
| | | .11 |
| | | .12 |
| | | .13 |
| .Employee | Evolve | .14 |
| | participation activities | |
| | Brainstorming | |

Generating a long
in a relative short period

Collective thinking

list of ideas

of time

Potential root causes

12-6

:

:

:

:

.1

"No idea is a bad idea"

.2

"The best way to have a good idea is to

.3

have a lot of ideas"

The Seven Tools of Quality Control



:Check Sheets

①

| Product Number: XXXXXX | | Line Name: ABC | | | | |
|---------------------------|-----------|----------------------|-----------|-----------|----------|-----------|
| Product Name: XYZ | | Process Name: XYZ | | | | |
| Defective Item | 2/5 (M) | 2/6 (T) | 2/7 (W) | 2/8 (T) | 2/9 (F) | TOTAL |
| Mold cracked | /// | /// | /// I | /// | /// | 21 |
| Fibers | /// | | /// | I | | 8 |
| Grit | /// | /// | /// | /// | | 14 |
| Pinholes | I | /// | | /// | I | 9 |
| Cracks | | I | I | | | 2 |
| Other | I | /// | | | /// | 7 |
| Total | 13 | 14 | 15 | 11 | 8 | 61 |

(Distinguishing between fact and opinion)

.1

.2

.3

in a systematic format

.4

.5

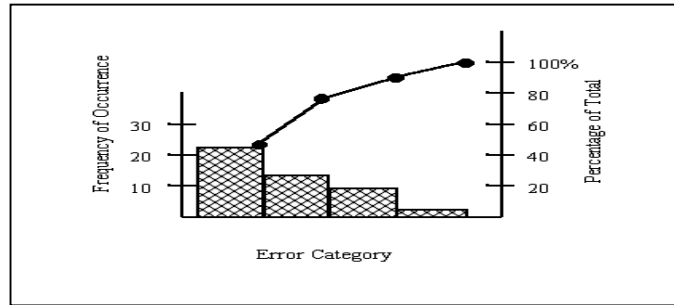
Pareto Chart (Pareto Diagram)

②

()

.()





(20/80) Pareto Principle

.20/80 . %20 %80

%20 %80 %20 %80 -

. 20/80 .

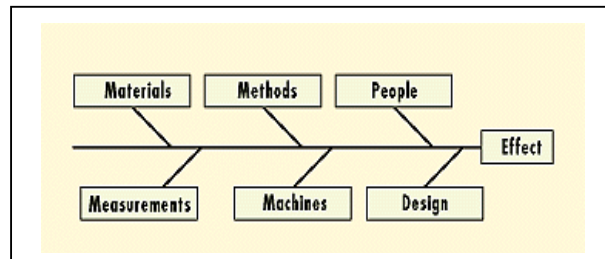
%20 %80 %80 %20

. %80 %20 .

. %80 ()

. %20

Cause & Effect Diagram or Ishikawa Diagram () ③
(Fishbone Diagram)



Visual tool
 Graphically

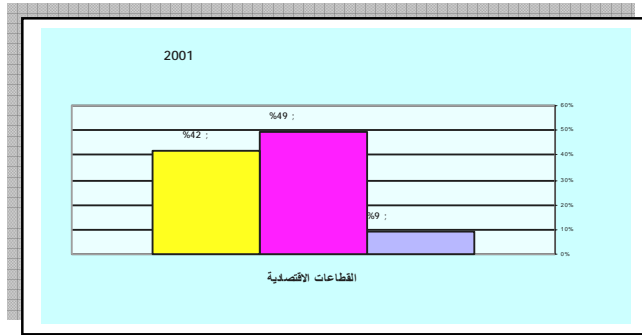
Explore
 Identifying root causes

()

.Fish Skeleton

GRAPHS ④





() Scatter Diagram

5

(x, y)

-

:

(x)

-

Cause

.Result

(y)

-

:

-

The strength

Predict

-

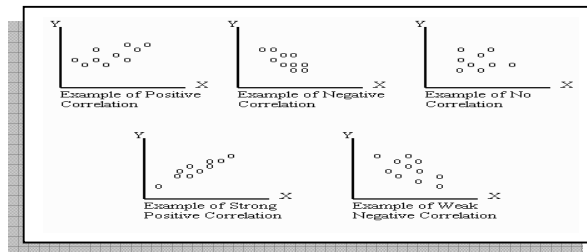
of relationship

:Correlation

()

"

"Correlation Analysis



Process Control Charts

6



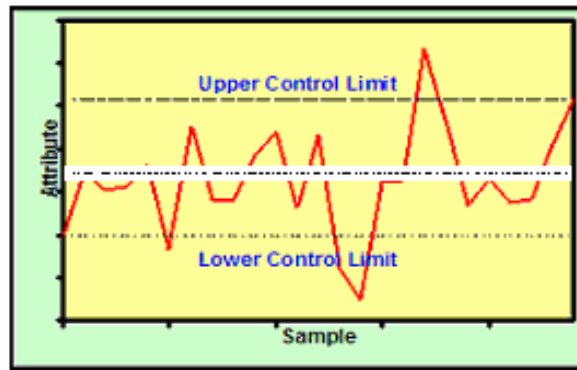
:Control Chart Concepts

Dispersions due to *Accidental, Common, Normal Causes* .1
 Chance,

- %100

Dispersions due to *Abnormal, Special,* .2
 Assignable, Causes

.Inadequate standards



Center Line

Upper Control Limit (UCL)

.Lower Control Limit (LCL)

Process Average

Center Line

Controlled Condition

Uncontrolled

.Condition



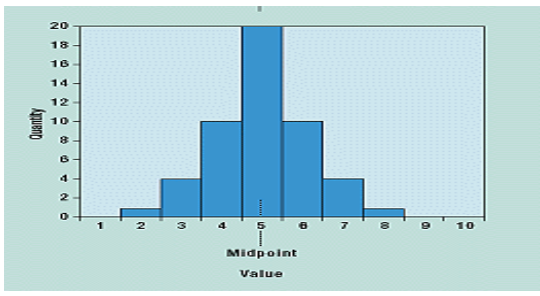
Histogram

7

Variations

Operating Standards

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FIVE "S" PRACTICES

Seiton

Seiri

Seitketsu

Seiso

.Shitsuke

(Making workplace more user friendly, cleaner and better organized)

:The Origin of the Term 5S

: (S)

(5S)



Seiri, Seiton, Seiso, Seiketsu, and Shitsuke

- Put things in order (Seiri) .1
out .

- Proper Arrangement, Simplifying (Seiton) .2

- Systematic Cleaning (Seiso) .3

- Standardize (Seiketsu) .4

.(Seiri-Seiton-Seiso.) 3 2 1

-Sustain (Shitsuke) .5

Self-disciplined

(Seiri, Seiton, Seiso, Seiketsu)

:(5S)

.1

.2

.3

(5S Cycle)

.4

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Improve on-time delivery

.1

Improve quality/ reduced defects

.2

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.3

Reduce lead times (

Reduce waste in materials, space

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.4

and time

Reduce inventory and storage costs

.5

Reduce of a specific machine

.6

changeover time

-

.7

Reduce Equipment Downtime, caused by malfunction

Improve Safety

.8

) Waste

.9

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KAIZEN

"Zen" Change

"Kai" –

"

"

For the better

(Taiichi Ohno & Shigeo Shingo)

"Kaizen"

.Use your knowledge not your money –

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Eliminate Waste

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:Large-Scale Improvements

.1

:Small-Scale Improvements

.2



"Poke-Yoke"

1961 Shigeo Shingo

TMC

Defect

Error

() -

"Yoke"

()

"Poka"

Poka-yoke

" ... Shingo

" Shingo

"Poka-Yoke"

Prevention device

.1

Detection device

.2

Just-In-Time

(TMC)

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JIT

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Total Productive Maintenance

TPM

TPM

Improve Productivity

.Asset availability

TPM

Rework

Breakdown

Defects

Rejected

TPM

TPM



| | | | |
|------------------|--------------|---------------------|------------|
| | | | TPM |
| | | | .1 |
| | | " | .2 |
| | | | .3 |
| | | | .4 |
| | | | .5 |
| Zero downtime of | | | .6 |
| zero accidents | zero defects | machinery/equipment | |
| | | | .7 |

SIX SIGMA

6

6

Defect 3.4

(Defects Per Million Opportunities – DPMO)

1983

3.4 Centerline

6

6

Mistakes

Rework

Eliminate Wastes

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Six Sigma



Service -related

Exceed Customer Expectations

Processes

Six Sigma -

Six Sigma -

Six Sigma

1983

6

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Six Sigma

Six Sigma

3.4

Six Sigma

Six Sigma

: Six Sigma

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.Six Sigma

BENCHMARKING

Best-in-class



The Search for those best practice that will lead to the superior performance of a company.

Xerox

Benchmarking Partner

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World class status

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