

## Chapter 4

# Other Philosophies and Tools of TQM

Dr. Md. Ahsan Akhtar Hasin

Professor

Industrial and Production Engineering (IPE)

BUET

## 4.1 Kaizen

Kaizen is a Japanese hybrid word. "Kai" means "change" and "Zen" means "good" (for the better).

Basically kaizen is –small incremental improvements carried out on a continual basis, and involve all people in the organization.

According to Imai (1986), "Kaizen means continuing improvement in all areas".

The principle behind is that –

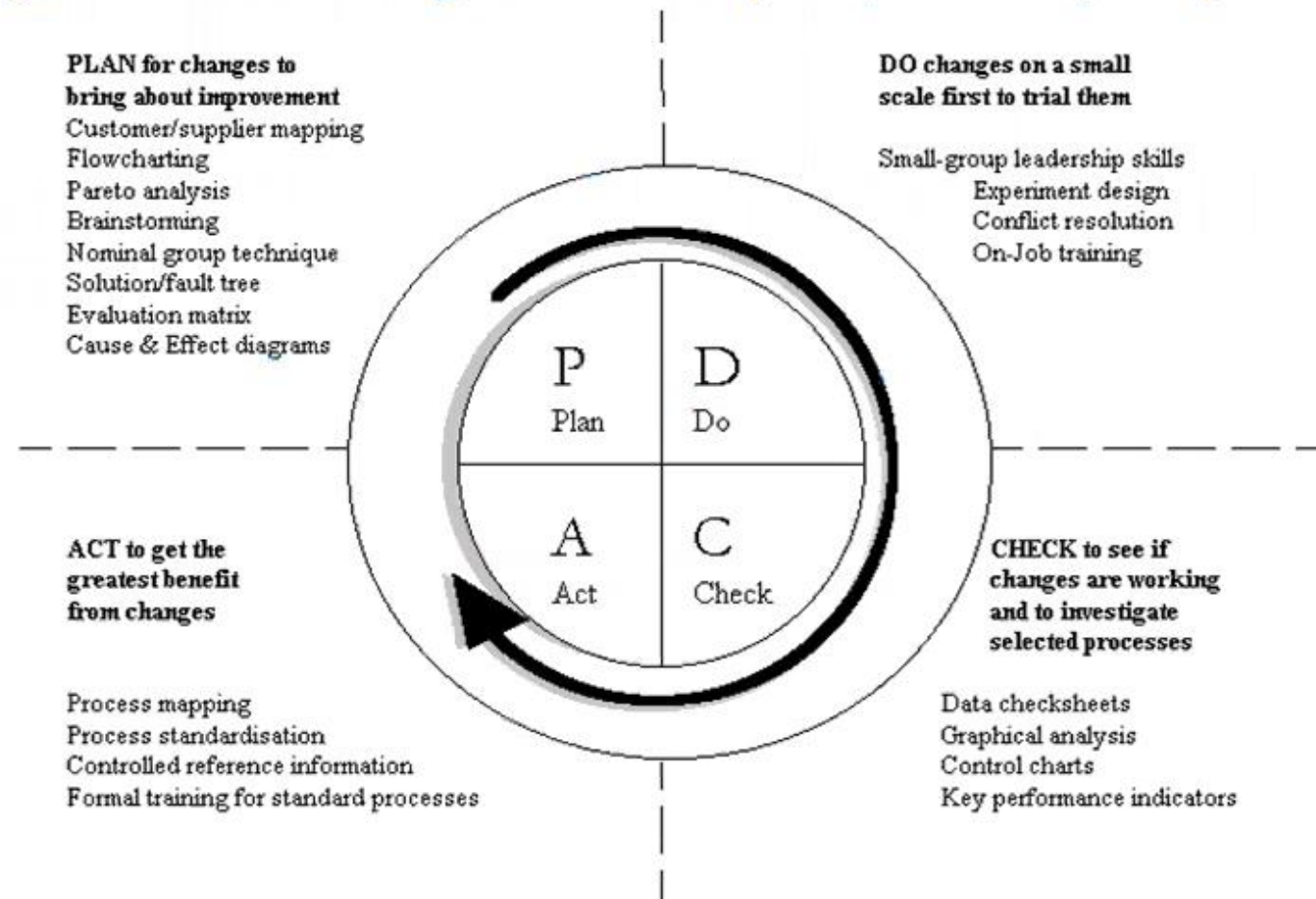
"a very large number of small improvements are more effective in an organizational environment than a few improvements of large value".

*TQM is the system to implement the culture of Kaizen*

## 4.2 PDCA Cycle

The concept of the PDCA Cycle was originally developed by **Walter Shewhart** of Bell Laboratories during the 1930's, leading to a name '**The Shewhart Cycle**'.

It was taken up and promoted very effectively from the 1950s on by the famous Quality Management authority, **W. Edwards Deming**, and is consequently known by many as '**The Deming wheel**'.



## 4.3 Quality Function Deployment (QFD)

Quality Function Deployment (QFD) is a structured approach translating customer needs or requirements into specific plans in 4 steps –

1. Product plan
2. parts/components
3. process plan and
4. production plan

The "Voice of the Customer" (VOC) is the term to describe these stated and unstated (but implied) customer needs or requirements.

This also known as “House of Quality (HOQ)”

### 4.3.1 Background / History

Arguably, the initial concept of QFD was originated in a Japanese Ship building firm in the early 1970s.

It was first formally introduced in Mitsubishi Heavy Industries Limited of Japan in 1972.

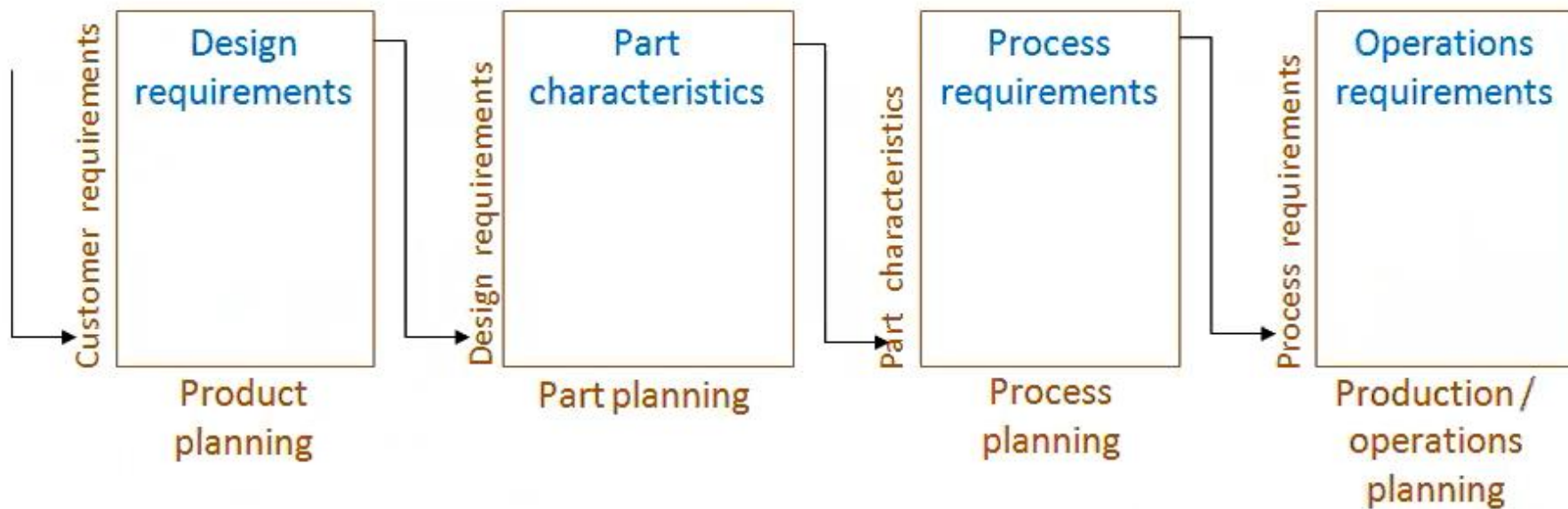
However, it was brought into the academic world in a more formal and systematic manner by Dr. Yoji Akao and Dr. Shigeru Mizuno in their groundbreaking book “Facilitating and Training in Quality Function Deployment” in 1978.

QFD was then adopted by the Japanese automobile industry in the early 1980s.

The US automobile industry started using it in the mid of 1980s.

John Hauser and Don Clausing of MIT are instrumental in popularizing the concept and use of QFD through their article “House of Quality” written in Harvard Business Review.

### 4.3.3 Methodology of QFD



# An example of refrigerator design using opinions (inputs) from customers

- ⊙ ○ ■ Symbol      Score  
 ⊙ - Strong relationship (9)  
 ○ - Moderate relation (3)  
 ■ - Weak relationship (1)  
 Blank – No relationship

		Compressor design		Electrical design			Physical aspects		Mechanical design		cost								
		Compressor capacity	Insulation	Fluid circulation speed	Thermostat, wiring	Fan, capacitor	Motor design	Color and shape, tray	Refrig. Height & width	Cooling speed	Warranty, maintenance	Operational & fixed cost (Material type and others)	Importance (10)	We today (10)	Target in future (10)	Improvement ratio	Sales point	Scores	Percent score (100)
Operations	Low Energy Consump.	■	■		⊙	○	⊙			○			7	8	9	1.1	1.1	8.5	7
	Quiet					⊙	○			■			5	7	8	1.1	1.0	5.5	5
	Apppr. Temperature	⊙	■	○	⊙	⊙				○			10	7	9	1.3	1.5	20	18
	Food Freshness	○	○	⊙	■	⊙				⊙			10	7	9	1.3	1.3	17	15
Physical	Space, interior							⊙	⊙				9	6	8	1.3	1.5	18	16
	Color, exterior					○		⊙	⊙				7	7	8	1.1	1.5	12	11
	Easy to clean							○	■	○			4	5	7	1.4	1.1	6	5
Reliability	Reliability		■		○	○	○			⊙			9	7	8	1.1	1.1	11	10
Price	Low cost	■						■	○	○	⊙		8	7	9	1.3	1.4	15	13
Score (Sum $\Sigma$ = 2334)		227	80	189	270	426	108	271	287	215	144	117	Sum 113						
Percent score (100)		10	3	8	12	18	5	12	12	9	6	5							
Cost (in percentage)		20	15	1	5	6	10	5	15	5	8	10							

## 4.4 Quality Circle (QC)

A Quality Circle is –

- an autonomous volunteer group of employees
  - involved in the same work area or performing similar functions
  - who meet together on a regular basis to discuss problems and solve them.

- The circle is a relatively autonomous unit (ideally about ten workers),
- Usually led by a supervisor or a senior worker – known as Team Leader

## 4.4.1 Background / History

Quality circle is typically said to have originated in Japan in the 1962.

But others argue that the practice started with the United States Army soon after 1945, with the Japanese then adopted and adapting the concept and its application.

What ever be the root of QC, [Kaoru Ishikawa](#) may easily be credited for creating the formal modern concept of Quality Circles.

However, [Edward Deming](#) popularized the idea of QC among Japanese industries..

## 4.5 Root Cause Analysis

If there is an unwanted recurring harmful situation



Root Cause Analysis

## 4.7 Benchmarking

Benchmarking primarily targets adoption of best practices in the society.

### 4.7.1 Background / History

Modern deployment of word “benchmarking” makes reference to a “*Standard*” by which others may be measured and compared, with the target of adopting better approaches.

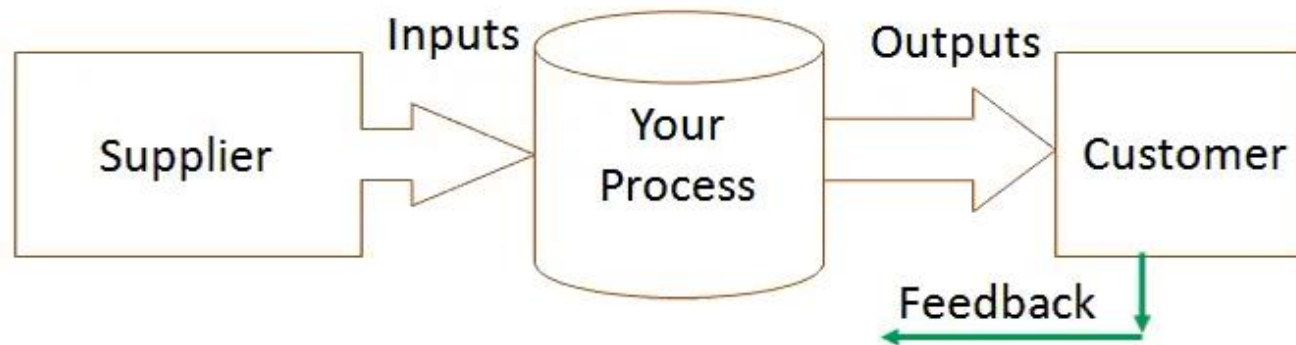
In 1979, **XEROX** company redefined benchmarking as the process of adopting the practices of “better (in specific areas/processes) competitors”.

## 4.8 Business Process Reengineering (BPR)

*"the **radical redesign** of existing business processes to achieve breakthrough improvements in performance measures"*

## 4.8.1 What a business process is

Davenport & Short defined *business process* as –



According to Davenport, a renowned fellow of BPR, *processes have two important characteristics*:

- (i) They have customers (internal or external),
- (ii) They cross organizational boundaries, i.e., they occur across or between organizational subunits.

## 4.8.2 How does BPR Differ from TQM



Figure 4.9: Continuous improvement model (TQM).



Figure 4.10: Business Process Reengineering (BPR).

Table 4.3: *Process improvement (TQM) versus process innovation (BPR)*

Aspects	TQM	BPR
Level of change	Incremental	Radical
Starting point	Existing process	Clean slate
Frequency of change	Continuous	One-time
Time required	Short	Long
Participation	Bottom-up	Top-down
Typical scope	Narrow, within functions	Broad, Cross functional
Risk	Moderate	High
Primary enabler	Statistical control	Anything, including IT
Type of change	Cultural	Structural

## 4.10 Failure Mode and Effect Analysis

It is a proactive quality control  at the design stages

### 4.10.1 What it is

It is a proactive tool, technique and quality method that enables the identification and prevention of process or product errors before they occur.

FMEA evolved as a process tool used by the United States military as early as 1949, but application in other commercial manufacturing areas started some decades later.

## 4.10.2 Types of FMEA

1. **Design FMEA** : It assesses the critical points of product, or service design.
2. **Process FMEA** : It analyzes the processes producing the product or service.

### 4.10.3 Methodology

It basically involves a –  
step-by-step diagnosis procedure,  
quantify the risk of failure (in terms of RPN) and  
its consequence.

RPN may be defined as follows:

$R = \text{Risk Priority Number (RPN)} = P \times S \times D$ , where,

P (Probability of Occurrence)

S (Severity)

D (Detection)

## An exemplary FMEA Form

Sub-system Name: DC Motor

Model Year/Vehicle: 2005

P = Probability/chance of occurrence

S = Severity/Seriousness of Failure

D = Likelihood that the defect will reach the customer

R = Risk Priority Number (  $P \times S \times D$  )

Final Design : 31/5/2005

Prepared by: \_\_\_\_\_

Reviewed by: \_\_\_\_\_

FMEA Date: Original 27/4/2005;

Revised 31/5/2005

No.	Part Name	Function	Failure Mode	Mechanisms & causes of failure	Effects of failure	Current control	Risk				Recommended corrective actions	Actions taken
							P	S	D	R		
1	Position controller	Controls the position from input signal	Loose cable connection	Wear and tear	Motor fails to move		2	4	1	8	Replace faulty wire	Wire changed (3/6/05)
			Incorrect demand signal	Operator error	Position controller breakdown in the long run		4	4	3	48	Intensive training for operators	Training

1 – very low, or none

4 – High

2 – Low, or minor

5 – Very high/ Catastrophic

3 – Moderate or significance

(instead of 1-5 scale, many users apply 1-10 scale as well).