

# CONTINUOUS IMPROVEMENT



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Project Title: Lean Learning Academies (LLA)

Project Number: 503663-LLP-1-2009-1-BE-ERASMUS-ECUE

Grant Agreement: 2009 – 3308 / 001 - 001

Sub-programme or KA: ERASMUS



Education and Culture DG

Lifelong Learning Programme

**Disclaimer:**

This project has been funded with support from the European Commission. This publication [communication] reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

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5 Why's

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Kaizen Workshops



# CONTINUOUS IMPROVEMENT

The Japanese words Kai-zen means

Kai (way)

Zen (good/for the better)

These words are translated to

Continuous Improvement

# CONTINUOUS IMPROVEMENT, HISTORY AND PHILOSOPHY

The concept of Kaizen/CI goes back to Taiichi Ohno, founder of the Toyota production system.

Continuous improvement is the process of making small/incremental improvement in order to eliminate waste.

# THE 5 MAIN ELEMENTS OF KAIZEN

- Teamwork
- Personal discipline
- Improved morale
- Quality circles
- Suggestions for improvement

# PREREQUISITES FOR CONTINUOUS IMPROVEMENT

- Waste elimination awareness.
- Standardized work in order to verify that changes made actually are improvements.

# TOYOTA 'S PROBLEM-SOLVING PROCESS

- 1 Initial problem perception
- 2 Clarify the problem
- 3 Locate area/point of cause
- 4 Investigation of root cause
- 5 Countermeasure
- 6 Evaluate
- 7 Standardize



# TOOLS FOR PROBLEM SOLVING AND IMPROVEMENT

8D

Root/cause analysis (Ishikawa)

4M

5W2H

5 Why's

PSS, problem solving sheet

Kaizen Workshops



## 8D OR FORD 8 DISCIPLINES

The 8D problem solving approach is used to identify, correct and eliminate recurring quality problems. It is an problem solving methodology for improvements for both product and process.



## 8D HISTORICAL BACKGROUND

A similar method was used by US Government during Second world War. Military standard 1520 (Corrective action and disposition system for nonconforming material.)

Ford Motor Company documented the 8D method 1987 as "Team oriented problem solving"

# 8D METHOD

- D0 -Prepare awareness
- D1 -Establish the team
- D2 -Describe the problem
- D3 -Implement and verify interim containment actions
- D4 -Identify and verify root causes
- D5 -Choose and verify corrective actions
- D6 -Implement and validate permanent corrective actions
- D7 -Prevent reappearance
- D8 -Congratulate the team

## Prepare awareness

D0 is the step before the problem solving where the organization can be informed about the work, and be trained to use the methodology.

## **Establish the team**

Gather a cross-functional team. Team must be given both time and authority in order to solve the problem and implement corrective actions.

In this step all prerequisites for an effective team is set, such as structure, roles and procedures.

## **Describe the problem**

In this step the problem is been defined in measurable terms.

This could be done by using the 5W2H analysis.

## **Implement and verify interim containment actions**

Protect customer from the problem by implementation of intermediate corrective actions until permanent action is implemented. Verify effect of the temporary fix. Extra quality control to gather data for verification can be necessary.



## **Identify and verify root causes**

Identify all potential causes to the occurring problem. Analyze/test each potential cause against the occurrence of the problem.

Cause and effect diagram is useful in detecting possible causes to the problem

## **Chose and verify corrective actions**

Confirm that selected corrective actions solve the problem and make sure that no undesired side effects occur. If needed define eventual additional actions based on severity of side effects.

## **Implement and validate permanent corrective actions**

Insure that root cause is eliminated with controls. Monitor long-time effects and implement additional controls and corrective actions if necessary.

## **Prevent recurrence**

Update specifications, instructions, training and improve management and operating systems. State the new standard.

## **Congratulate the Team**

Pay tribute to the collective effort and spread the knowledge throughout the organization.

# PROS AND CONS OF 8D

## **Pros**

Effective method finding the root cause of a problem and to develop proper corrective actions to be implemented. Helps to explore both the system which allowed the problem to occur and the control system which let the problem pass without warning.

## **Cons**

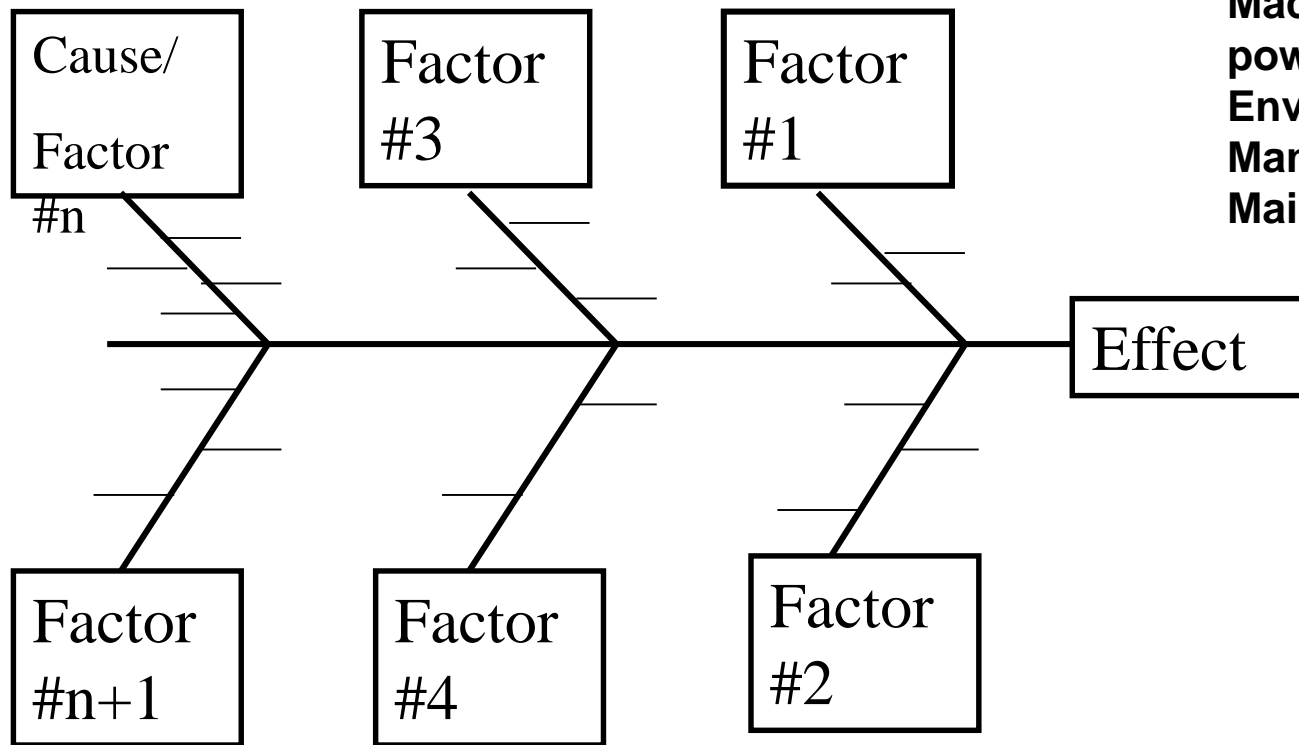
Could be time consuming and difficult to develop and executing training of 8D.

# ROOT/CAUSE ANALYSIS (ISHIKAWA)

Root cause analysis is using a Cause Effect diagram also called Ishikawa-diagram or Fishbone-diagram.

The diagram is shows different causes for a specific event. It is used for product development but more commonly identifying causes of quality problems.

# CAUSE AND EFFECT ANALYZE - ISHIKAWA-DIAGRAM



## Typical factors

**Machine, Method, Man  
power, Measurement,  
Environment,  
Management,  
Maintenance**



# ROOT/CAUSE ANALYSIS (ISHIKAWA) HISTORICAL BACKGROUND

The diagram was developed by Kauro Ishikawa, a professor of Tokyo University. He invented the diagram in order to graphically illustrate hierarchical relations between causes of a given effect/outcome. This is useful for complex relationships between different causes. The Ishikawa-diagram is one of the seven basic tools for quality control.

# ROOT/CAUSE ANALYSIS (ISHIKAWA) METHOD

- 1 Specify the problem to be analyzed to be put in the box in the diagram.
- 2 Draw the fish bone diagram on Whiteboard or wallpaper.
- 3 Conduct a brainstorming activity, open minds essential.
- 4 Choose the main categories of causes/factors to be used as labels, 6M/8P. (Pareto analysis could be used to support decision.)
- 5 Each cause from the brainstorming is put under appropriate label in a hierarchical way, more and more detailed. Note that same cause can be sorted into multiple categories and if so, should be placed there as well.
- 6 Analyze the diagram in purpose to find the root cause/causes.
- 7 Act on the diagram and remove the causes of the problem.

## 6 ANALYZE THE DIAGRAM ...

Different approaches:

- Through open discussion using consensus.
- By looking for causes which are found under multiple labels.
- By the use of gathered data presented in a
- Pareto diagram.
- Choosing causes which the team have an influence on.

# PROS AND CONS OF CAUSE EFFECT ANALYSIS

## Pros

- Helps to gather all possible causes of a problem, not just the most obvious.
- Uses all the collective knowledge
- Puts focus on causes and not symptoms.
- Visualizes areas for further studies.

## Cons

- Less useful for extremely complex problems with interrelated causes.

This is basically the same method as Cause effect analysis, where the categories has been limited to 4 specific factors.

In industrial practice different approaches of use can be detected.

One with a management perspective with detailed questions regarding the 4 categories, manpower, machine, material and method.

The other one has a shop level perspective where 4M is a tool/checklist for production teams to use in quality issues.

This is basically the same method as Cause effect analysis, where the categories has been limited to 4 specific factors.

- Man power
- Machine
- Material
- Method

These are categories which the shop level team have an influence on and can work with a checklist approach.

# CHECKLIST 4M

The 4M categories, man power, machine, material and method are categories which the shop level team have an influence on.

Note, Checklist should be constructed with no loopholes in order to fulfill the purpose of finding root causes in the chosen categories.

Example category Method:

Are instructions available? Y/N

Are the instructions understandable? Y/N

Are the instructions obeyed? Y/N

Do the instructions ensure the specified quality? Y/N

If one of the questions is missing, excluding method as cause for quality problem would be a mistake.

# PROS AND CONS OF 4M

## Pros

- Covers the area of responsibility for shop floor personnel.
- Simplifies analyzing

## Cons

- Simplification excludes perspectives outside the M's chosen.



## 5W2H HISTORICAL BACKGROUND

The origin of the tool 5W1H or 5W2H is uncertain. It is argued that the first reference would be the poem "Six honest serving men" written by Rudyard Kipling.

"I keep six honest serving men,

They taught me all I knew:

Their names are What and Why and When  
and How and Where and Who."



## 5W2H METHOD

The purpose of the 5W2H method is to examine and question a process or problem in order to gather information for a good description of a problem. Data/information should cover following questions:

What, When, Where, Who, Why, How and How much.

# 5W2H TEMPLATE

Experienced problem/disturbance

What	What is the problem?	
When	When did the problem occur; time, after stop....?	
Where	Location, machine, component?	
Who	Personnel; individual, team, different shifts?	
Why	Identify known explanations	
How	How detectable; noise reduced speed....?	
How much	Frequency, number of occasions'...?	

Problem description

# CRITICISM OF 5 WHY

Quotation of criticism by Teruyuki Minoura, former manager at Toyota

- Tendency for investigators to stop at symptoms rather than going on to lower level root causes.
- Inability to go beyond the investigator's current knowledge - can't find causes that they don't already know
- Lack of support to help the investigator to ask the right "why" questions.
- Results aren't repeatable - different people using 5 Whys come up with different causes for the same problem.
- The tendency to isolate a single root cause, whereas each question could elicit many different root causes

# PROBLEM SOLVING SHEET CHECKLIST/4M CHECKLIST

Problem owner	Dept/line/cell	Team/group	Date
Problem description			

Man power	OK	NOK	NA
Is operator/worker train/skilled for the task?			

Machine/equipment	OK	NOK	NA
Are stated/right machines/equipment available?			
Are machines/equipment working properly?			
Are machines/equipment used properly?			
Are machines/equipment maintained sufficiently?			

Material/components	OK	NOK	NA
Is right material available?			
Are materials/components stored in the right place?			
Are there risks for mix-up of different components?			
Are materials/components undamaged?			
Are materials/components according to specification?			
Is problem solved by changing material/component?			

Method	OK	NOK	NA
Are work instructions available?			
Are work instructions understandable?			
Are work instructions obeyed?			
Do work instructions ensure specified quality?			

- Workflow using 4M checklist for problem solving
- Conduct a 5 Why analysis for each question answered with NOK
- Use 5W2H for problem description for 5 Why's



# PSS PROBLEM SOLVING SHEET

For more complex or urgent problems the 4M checklist used by operators could be insufficient to solve the problem. Other tools have to be used and complementary competencies as well. In such cases Ishikawa diagram with more perspectives should be used. Statistical tools added, and the containment process from Ford 8D included.



# KAIZEN WORKSHOP

Kaizen workshop represents another kind of improvement work than Kaizen as continuous improvement. It is not the small incremental improvements you are aiming for. Instead it is break-through projects which leads to a giant leap in a very short time. Problems attacked are more complex or even chronicle quality issues.

# KAZEN WORKSHOP

Alternative names for Kaizen workshops are Kaikaku, Kaizen event or Kaizen Blitz.

The are all describing an actively striving for rapid improvement during a short period of time (often a week, excluded time for preparations). Kaizen workshops are commonly used for Setup reduction, (SMED projects) or work cell implementation.





# KAIZEN WORKSHOP PREPARATION

Following is described as the standard process defined by Industry forum in Great Britain. Industrial practice show numerous variants with small differences.

# KAIZEN WORKSHOP PREPARATIONS

- 1 day diagnose to select area and expected improvement.
- Period of data collection, approx 2 weeks
- 3 day diagnose setting the target for the activity and putting the core team together and education if necessary
- Period for some weeks for final preparations, checking all material needed at hand and support of maintenance personnel or others needed. Exceed production to stock in order fulfill deliveries during workshop.

Time periods seem long, and could be shortened if data collection is part of the business standard procedures.



# THE WORKSHOP

Commonly a 2-5 day activity during which time improvements to be implemented verified and reported. Action plans for complementing actions should also be stated. Workshop can be driven according to the PDCA-cycle or the DMAIC structure.

# EXAMPLE KAIZEN WORKSHOP, FLOW

Kaizen Workshop		PDCA	DMAIC
Day 1	Target setting, final measurements	P	DM
Day 2	Analysis	P	A
Day 3	Implementation, preferably 24 hour pilot	D	I
Day 4	Verification of result, adjustments, updating work instructions	C	C
Day 5	Reporting, spreading knowledge, updating action plans for further actions	A	

# PROS AND CONS OF KAIZEN WORKSHOP

## **Pros**

Change is done rapidly, changes are obvious, results are significant.

## **Cons**

The need for training seldom for filled. Overall process can be disturbed.

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