

Total Productive Maintenance (TPM)

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OUTLINE

- Types of maintenance
- Total maintenance system
- The six big losses reduce the efficiency
- The 5 causes of breakdown
- Breakdowns and reliability
- The importance of the loss deployment

PEOPLE, EQUIPMENT, TECHNOLOGY

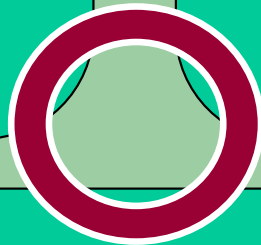
In the competitive environment the technology is the physical manifestation of the knowledge.

TECHNOLOGY

- ❖ CAD
- ❖ Computer Modeling
- ❖ CNC Machines
- ❖ Assembling robots
- ❖ Automatic Control
- ❖ Automatic store
- ❖

HOW THE TECHNOLOGY EFFECT THE BUSINESS

- ❖ Design → Easy to sell product
- ❖ Production → Required quality
- ❖ Operation → Low cost
- ❖ Delivery → Short lead time



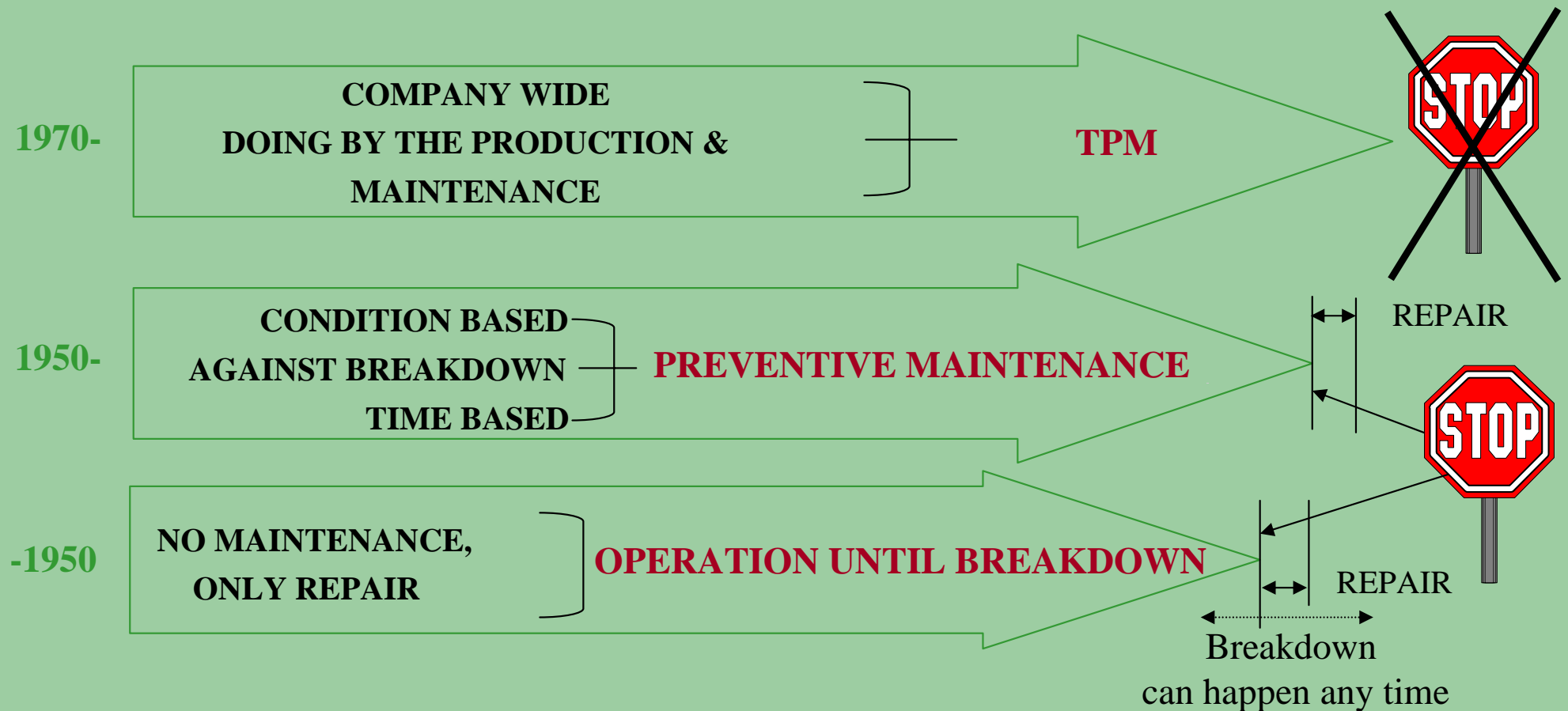
MAINTENANCE

It makes easy for the technology to perform appropriate effect for business

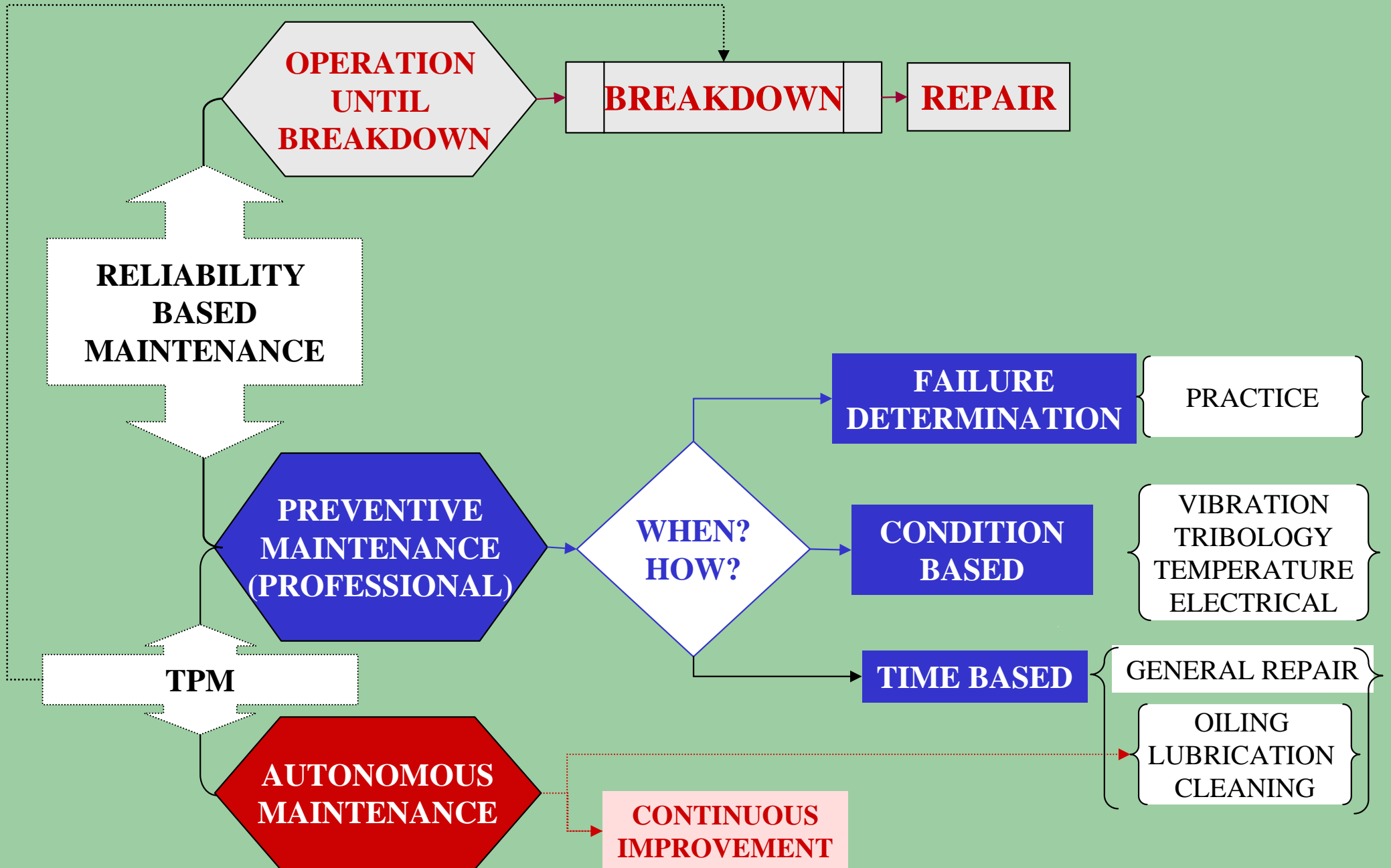
TYPES OF THE MAINTENANCE

164 COMPANIES WON TPM AWARDS FOR THE EXCELENT PLANT MAINTENANCE IN 2003

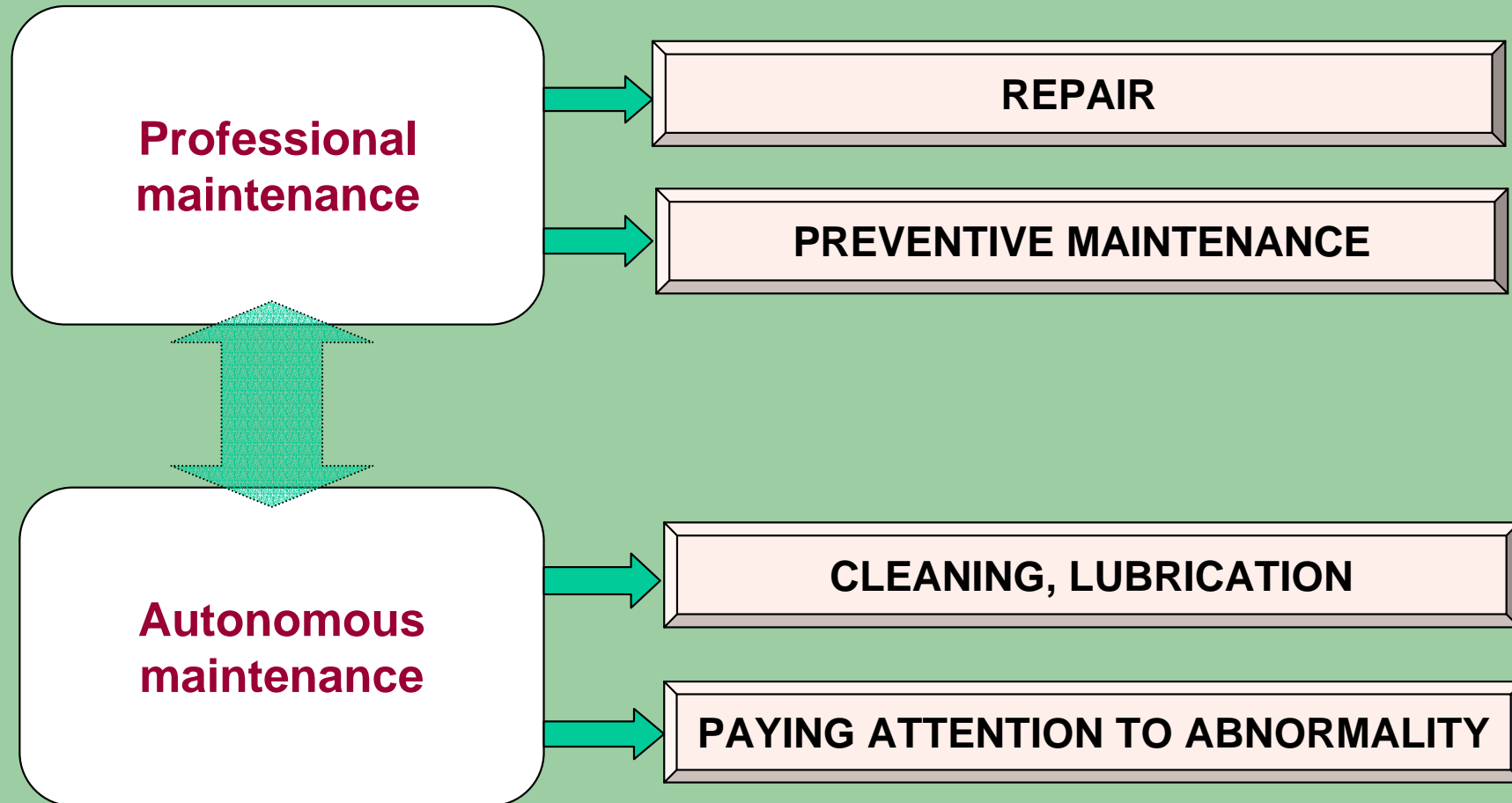
(JIPM Japan Institute of Plant Maintenance)



MAINTENANCE POLICY



TOTAL MAINTENANCE SYSTEM



TPM (TOTAL PRODUCTIVE MAINTEENANCE)

What is TPM ?

TPM is an acronym of **T**otal **P**roductive **M**aintenance and its more advanced form **T**otal **P**roductive **M**anagement.

TPM combines the American Preventive Maintenance practice and the Japan Total Quality Control.

The result is an innovative system what optimizes the efficiency, prevents machine breakdowns and support the autonomous maintenance in the daily practice.

TPM (TOTAL PRODUCTIVE MAINTENANCE)

The scope of TPM

- ⇒ **Reduction of the machine breakdown**
- ⇒ **Reduction of the repair time**
- ⇒ **Quality improvement**

TPM (TOTAL PRODUCTIVE MAINTEINANCE)

The targets and features of TPM

TPM target is to maximize the efficient usage of the machine during the whole lifecycle.

The operation of TPM needs the involvement of all organization units at all level.

This motivates the teamwork and the autonomous activity.

TPM includes the improvement of the operational/maintenance system, the implementation of the good housekeeping, the improvement of the problem solving ability to be achieve the “ZERO” breakdown, „ZERO” Accident, „ZERO” defect.

Top management should prepare an evaluation system.

Based on the evaluation system the ability and responsibility of the employee should be appreciated and/or rewarded.

SUPPLEMENTATION OF THE CONVENTIONAL MAINTENANCE

Requirements for the company: high level Production & Quality

Requirements for the employees

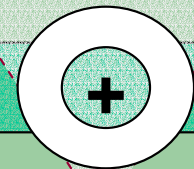
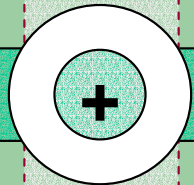
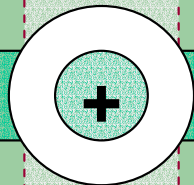
Multi qualification
Creativity
Changing job

Conventional maintenance

Operator = Operates the machine

Maintenance person = Maintenance + repair

Engineer = Production cycle planning



Daily checking
Observe the abnormality
Cleaning and lubrication

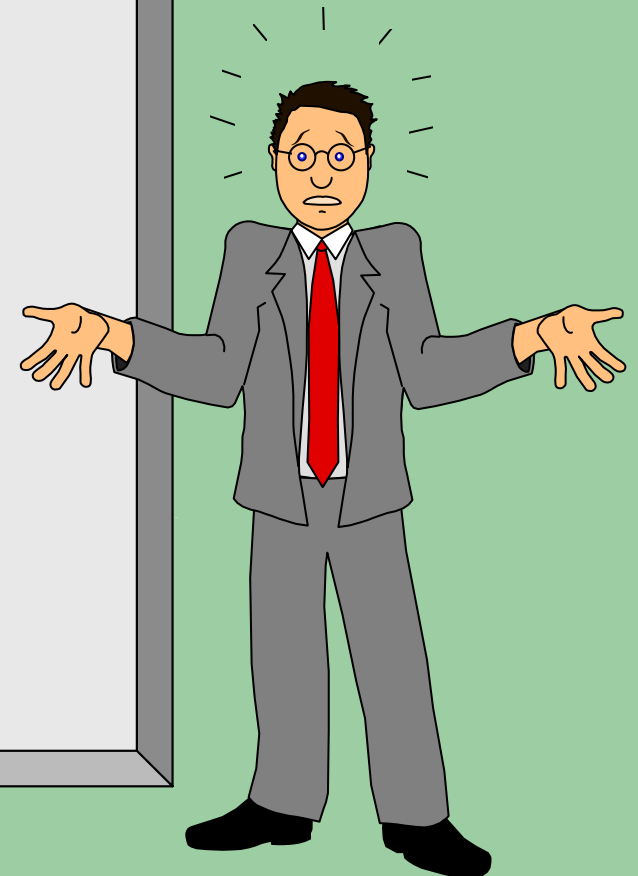
Quality knowledge

Maintenance planning
Planning for easy maintenance

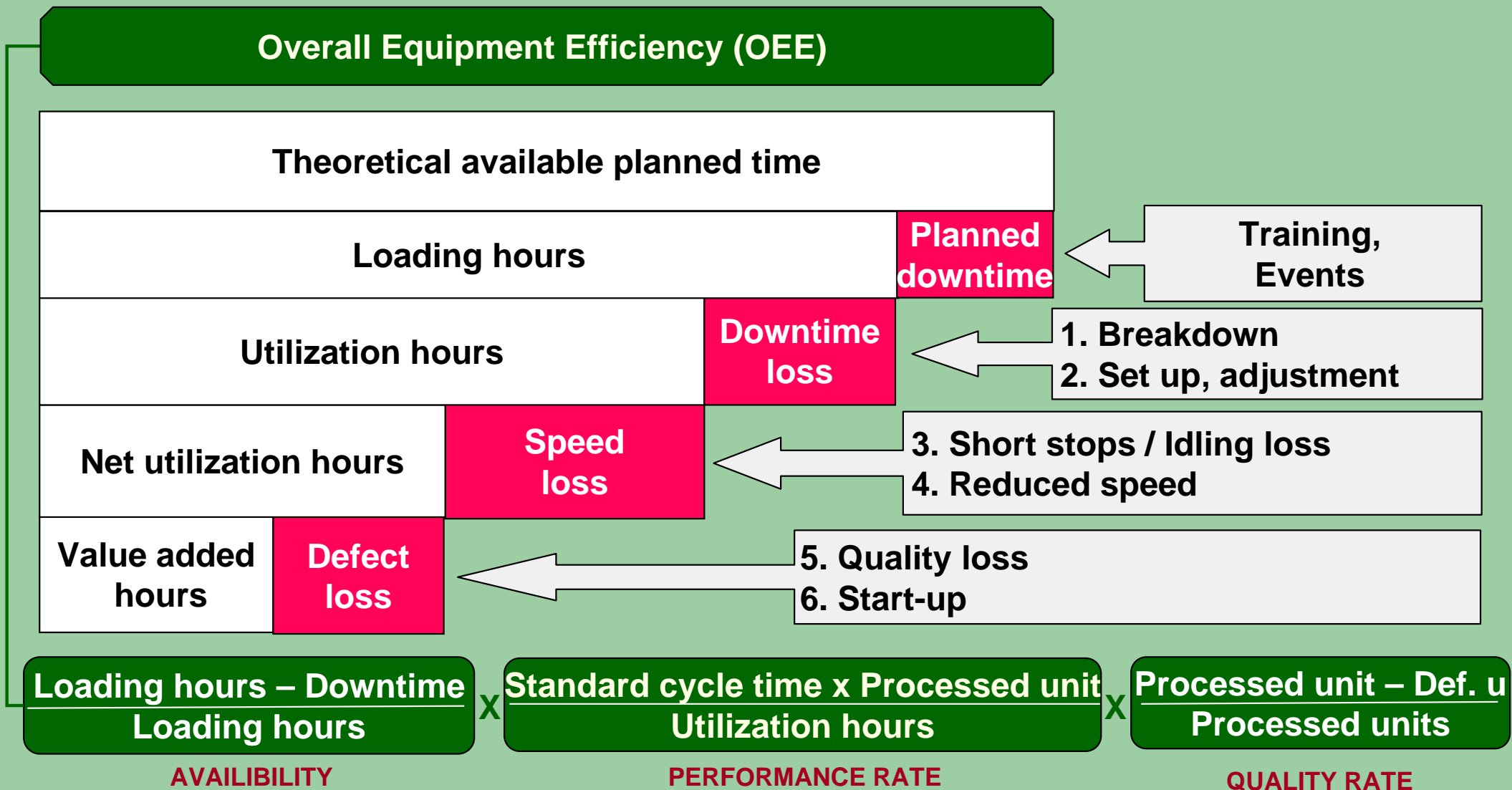
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THE SIX BIG LOSSES REDUCE THE EFFICIENCY

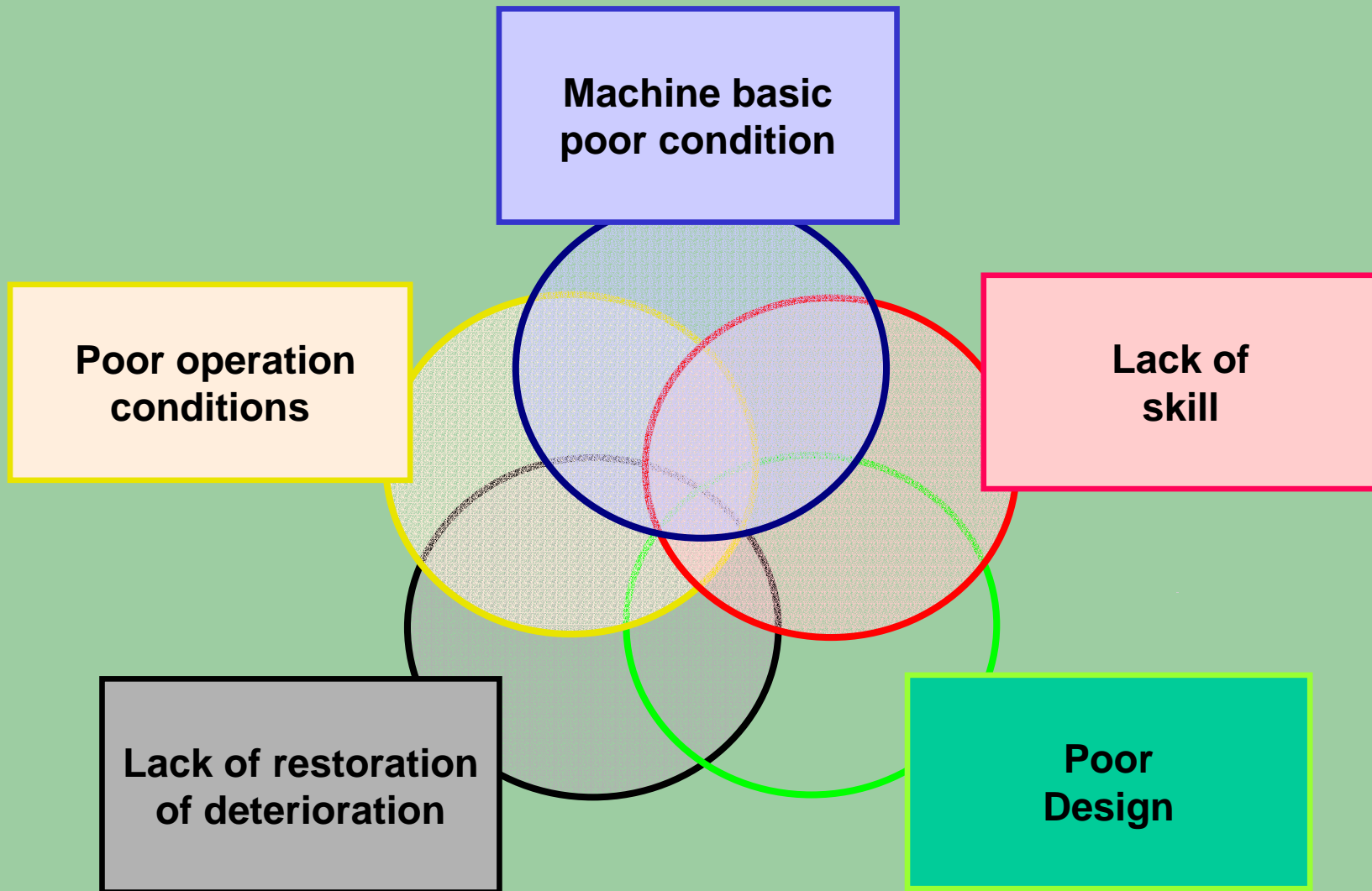
- 1! BREAKDOWN**
- 2! SET UP & ADJUSTMENT**
- 3! SPEED LOSS**
- 4! SHORT STOPS, IDELING**
- 5! START UP LOSS**
- 6! DEFECT & REWORK**



THE 6 BIG LOSSES AND „OEE” AS THE MAIN INDICATOR



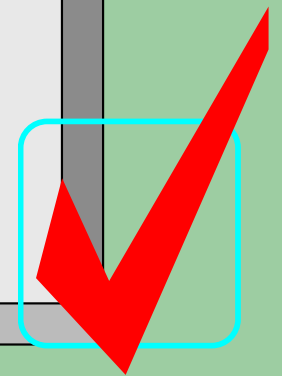
THE 5 COUSES OF BREAKDOWNS



BREAKDOWN PREVENTION

1. GUARANTEE THE BASIC CONDITIONS:

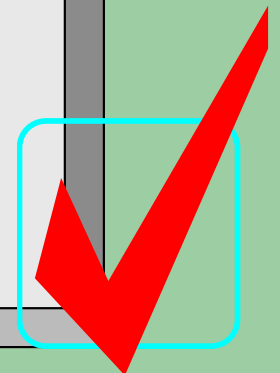
- MACHINE CLEANING → AT THE SOURCE OF THE DIRT
- TIGHTENING → FIX LOOSENING
- OILING → FILLED VOLUME LIST
- STANDARDS → CLEANING & LUBRICATION



BREAKDOWN PREVENTION

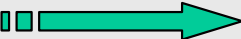
2. KEEPING THE OPERATION CONDITIONS

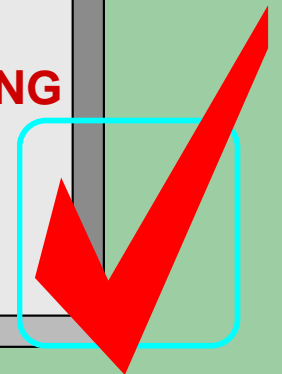
- DEFINE THE PLANNED CAPACITY AND THE LOAD LIMIT
- OPERATION METHOD STANDARDIZATION
- DEFINITION AND IMPROVEMENT OF THE USAGE CONDITIONS OF THE PARTS & UNITS
- DEFINITION OF THE PIPES & CABLES
- IMPROVEMENT OF THE IMPLEMENTATION INSTRUCTIONS
- PROTECTION AGAINST DUST AND WATER AT THE SLIDING & TURNING PARTS
- GUARANTEE THE ENVIRONMENTAL CONDITIONS IN TERMS OF DUST, TEMPERATURE, HUMADITY AND VIBRATION



BREAKDOWN PREVENTION

3. RESTORE THE DETERIORATION

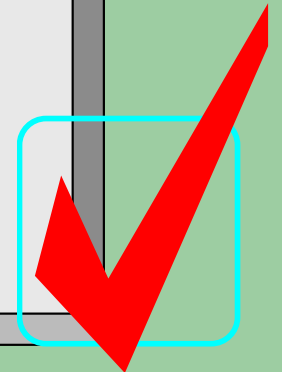
- **BIG CHANGES ARE RECOGNISED – SMALL CHANGES (DETERIORATION) SOMETIMES ARE OVERLOOKED BUT CAN MAKE SPORADIC BREAKDOWNS**
- **DETERIORATION SHOULD BE MONITORED**
- **THE NEGLECTED ACTIONS MUST BE DONE**  **CLEANING, OILING**



BREAKDOWN PREVENTION

4. IMPROVE THE MAINTENANCE

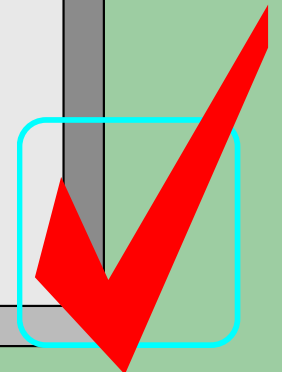
- ANALYZE THE BREAKDOWNS
- ESTABLISH A PREVENTIVE MAINTENANCE SYSTEM
- DEFINE STANDARDS FOR THE MAINTENANCE ACTIVITY
- TRAIN THE MAINTENANCE STAFF AND OPERATORS



BREAKDOWN PREVENTION

5. IMPROVE THE CONSTRUCTION

- IF THE RESTORATION IS NOT ABLE TO REDUCE THE FAILURES TO ZERO AND MAINTENANCE COST WILL INCREASE, IT IS NECESSARY TO CHANGE THE MACHINE DESIGN
- STEPS OF THE DESIGN CHANGING:
 - UNDERSTAND THE STATE OF THE MACHINE BEFORE AND AFTER FAILURE
 - STUDY THE STRUCTURE AND THE FUNCTION OF THE MACHINE
 - BE SURE THAT ALL OF THE DESIRED CONDITIONS WERE IMPLEMENTED ON A PROPERLY WAY
 - ANALYSE THE CAUSES
 - DEVELOPE AN IMPROVEMENT PLAN
 - IMPLEMENT THE PLAN AND MONITOR THE RESULT

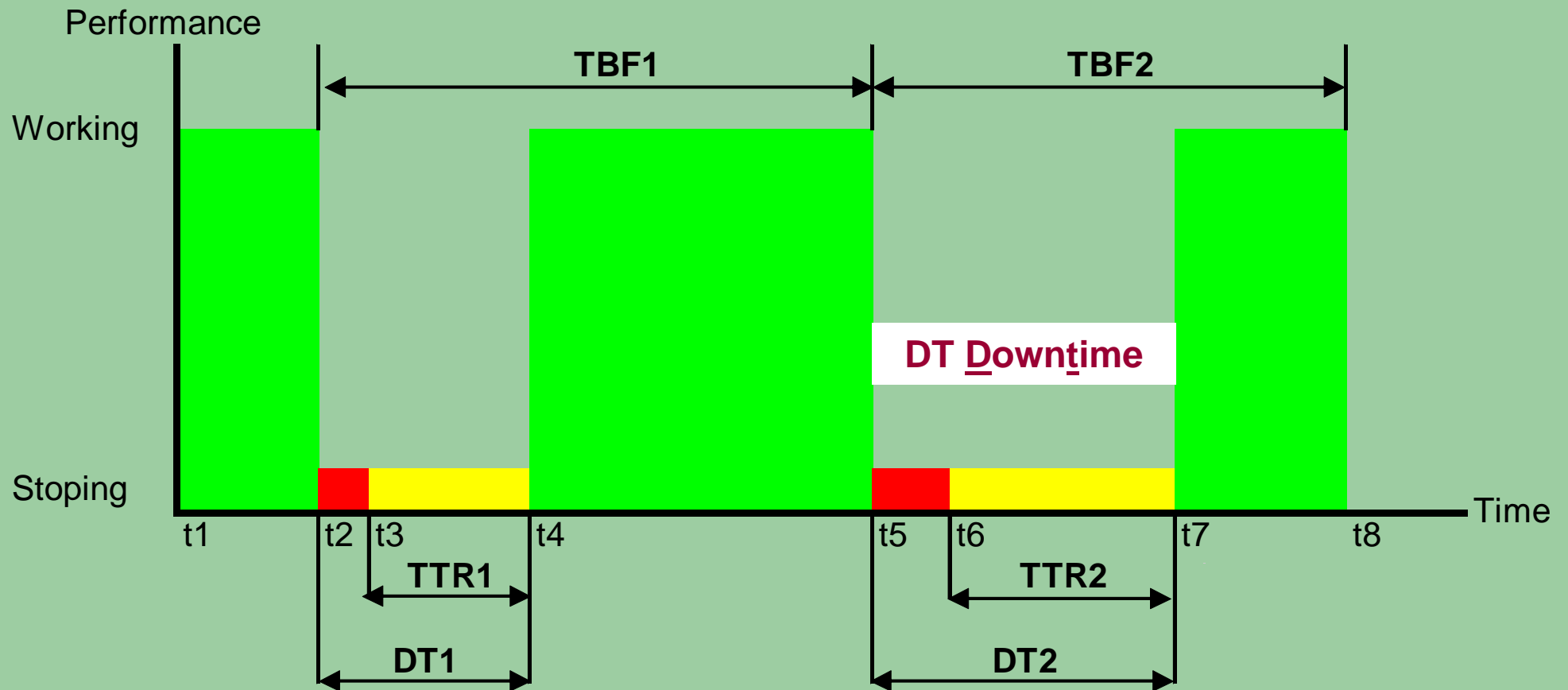


BREAKDOWNS AND RELIABILITY

MTBF indicator

Mean Time Between Failures

$$MTBF = \frac{TBF1 + TBF2}{2}$$



MTTR indicator

Mean Time To Repair

$$MTTR = \frac{TTR1 + TTR2}{2}$$

POINTS OF THE QUICK RESTORATION (After a breakdown occurs)

● Information flow

● Parts reserve

● Parts store

● Parts suppliers, service contracts

● Storing of the repair tools

● Skills training

Placement

Arrangement

Indication

Placement

Arrangement

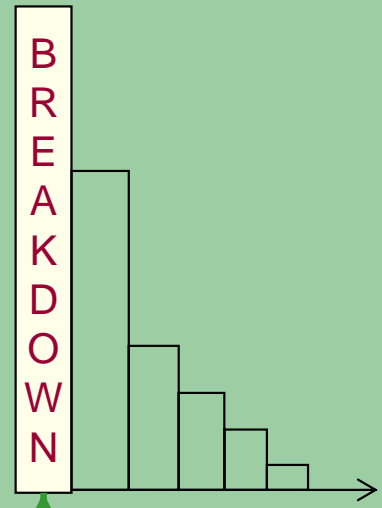
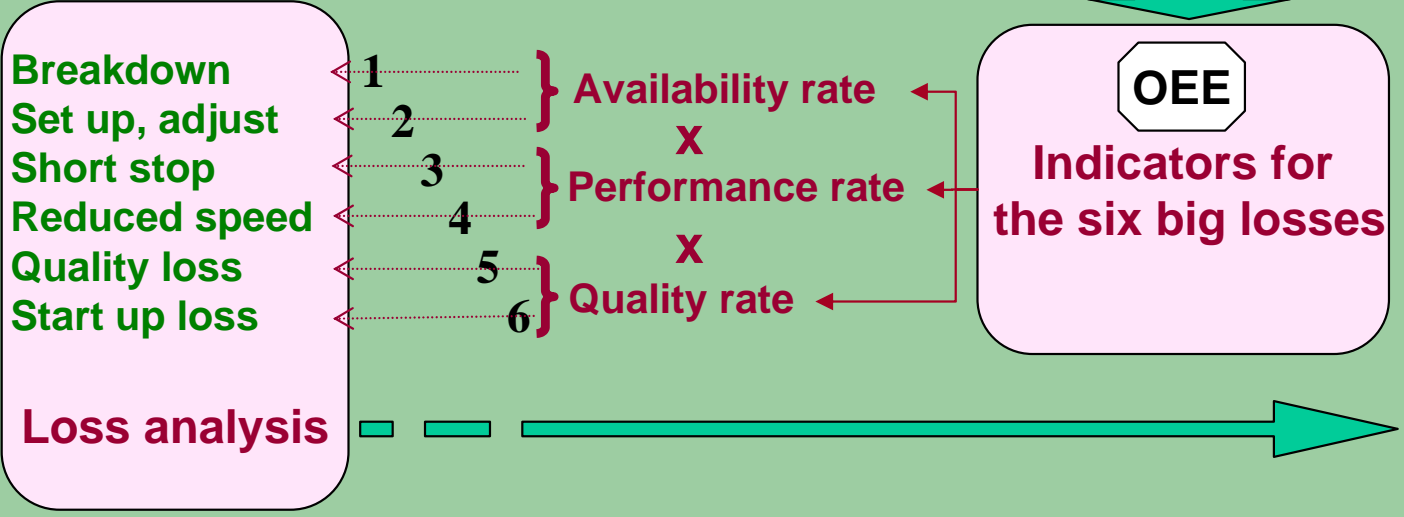
Indication

Organization

Downtime

TTR

PROFIT - PRODUCTIVITY - EFFICIENCY



- 1. Machine basic poor condition
 - 2. Poor operation conditions
 - 3. Lack of restoration of deterioration
 - 4. Poor design
 - 5. Lack of skill
- Operational failure Maintenance failure

Frequency
occurrence/week

Analyze the 5 main causes of the machine breakdown

Length
min/occurrence

Analyze the cause of the long repair time

- 1. Spare part
- 2. Organiz.
- 3. Tools
- 4. Training

TOTAL PRODUCTIVE

MAINTENANCE



MANAGEMENT PILLARS

TPM

Autonomous Management

Continuous Improvement

Planned Maintenance

Skill Development

Initial Phase Management