



**MÄLARDALENS HÖGSKOLA
ESKILSTUNA VÄSTERÅS**

VÄSTERÅS

ESKILSTUNA

ÖREBRO

STOCKHOLM

TPM

Total Productive Maintenance



TPM - definition

- TPM can be defined as a *systematic work method* aiming to develop disturbance free *processes* at *lowest possible cost* through the commitment of *all co-workers*
(LCP-Consultants)



TPM – Total Productive Maintenance

- Total Effectiveness
- Total Preventive Maintenance
- Total Commitment

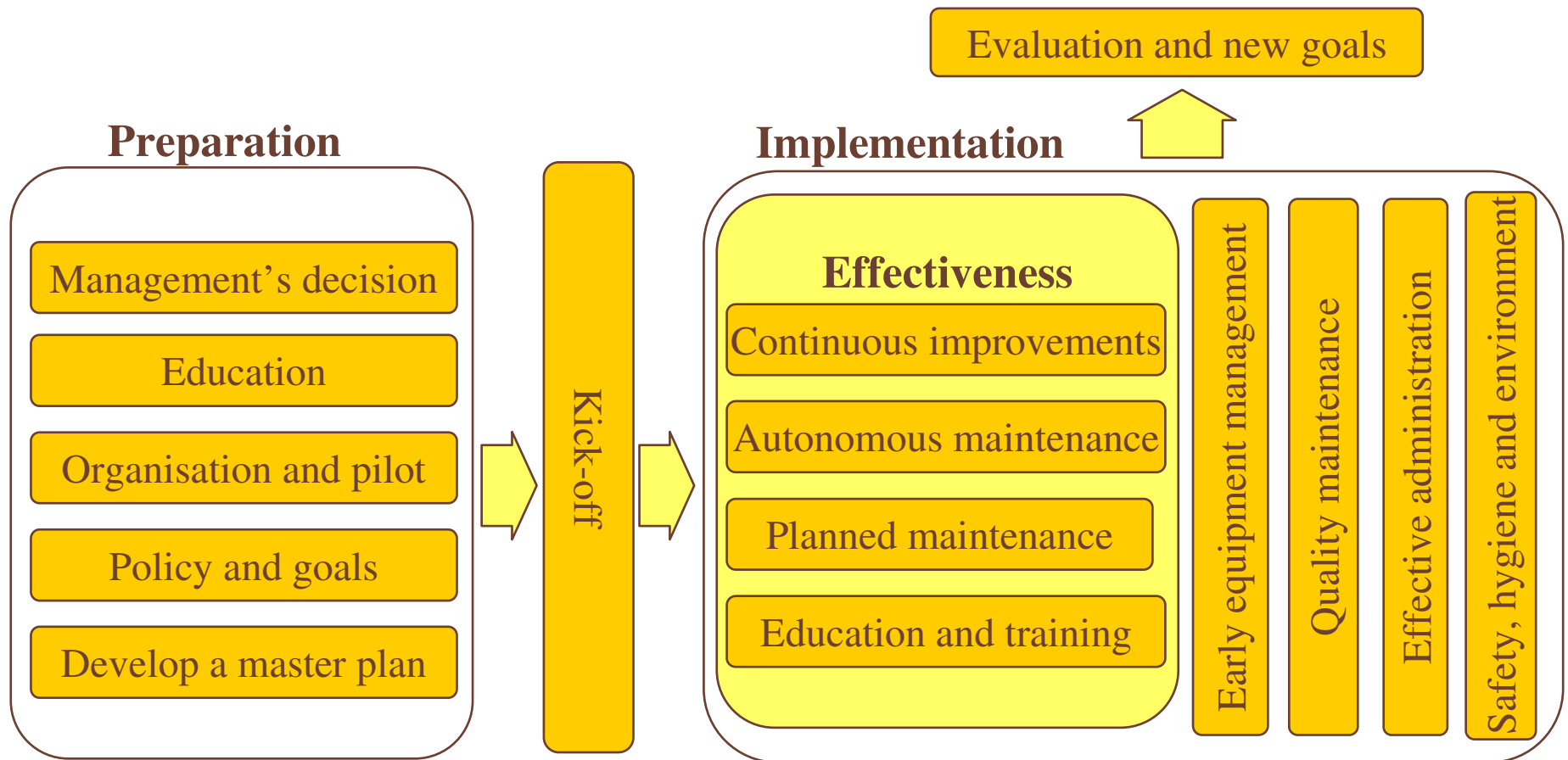


Why TPM?

- Replace routine with development
- Increased commitment from all co-workers
- Continuous improvements
- Foreseeable operations
- Improved safety and environment

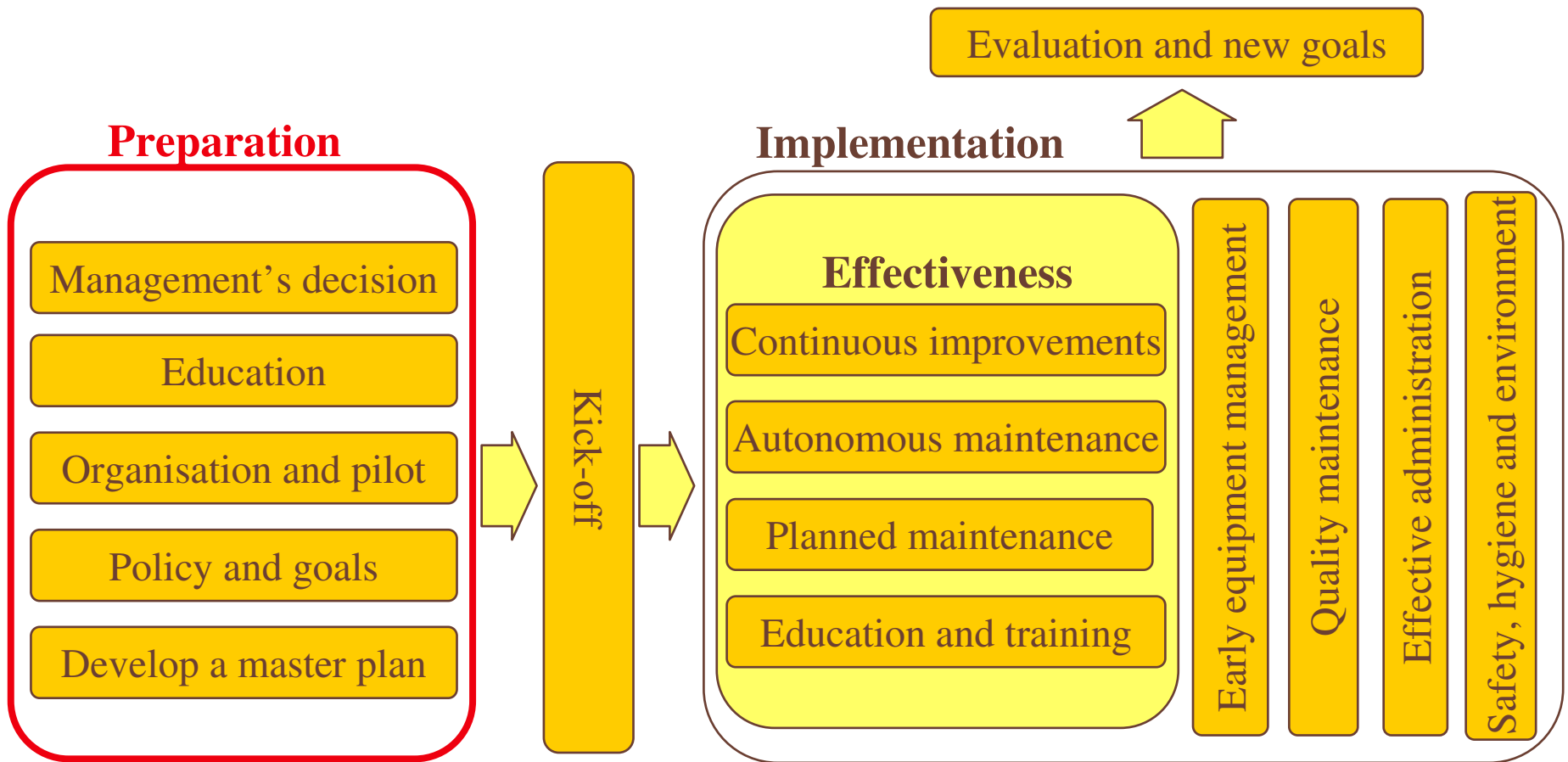


TPM Structure



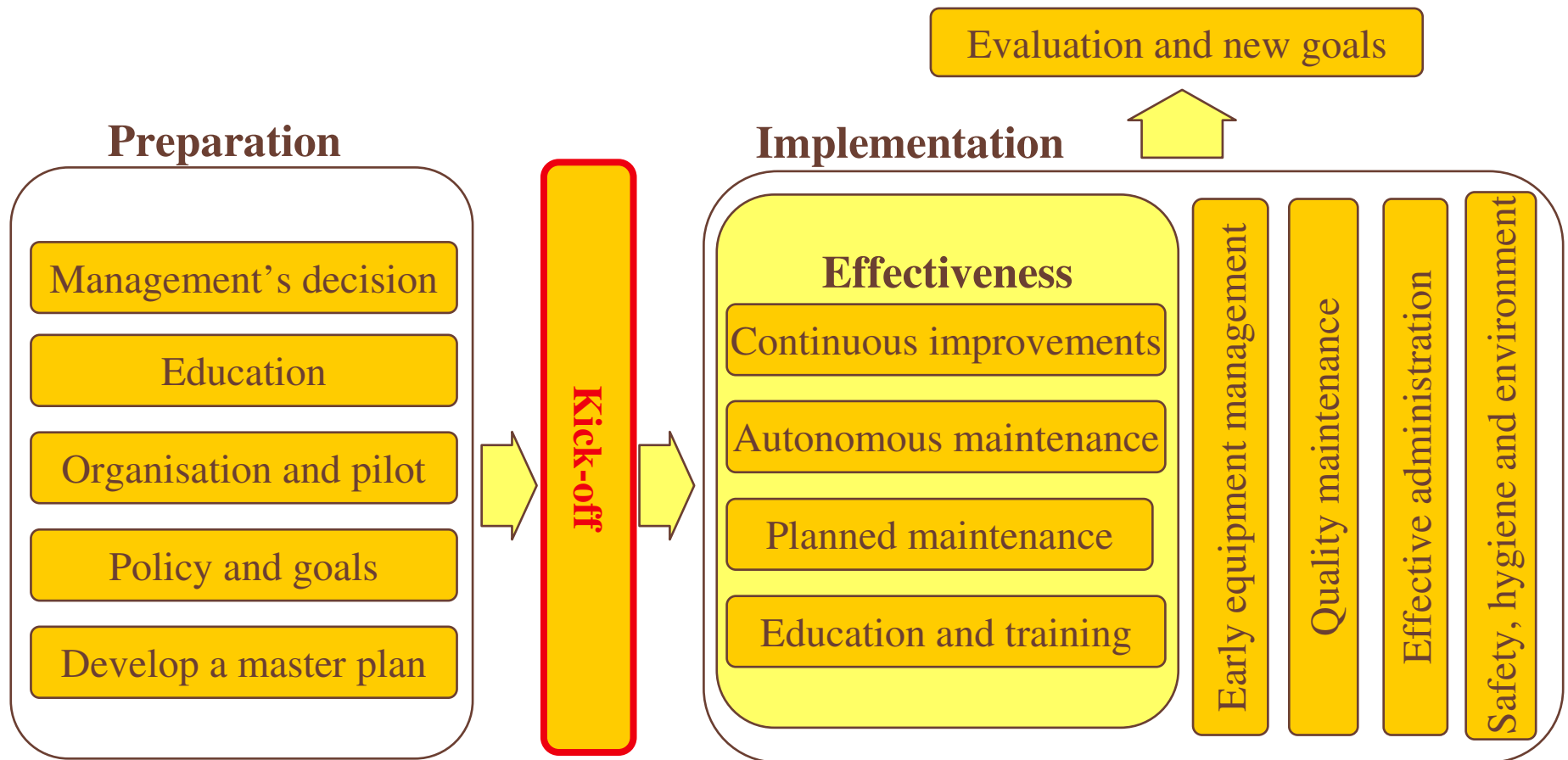


TPM Structure



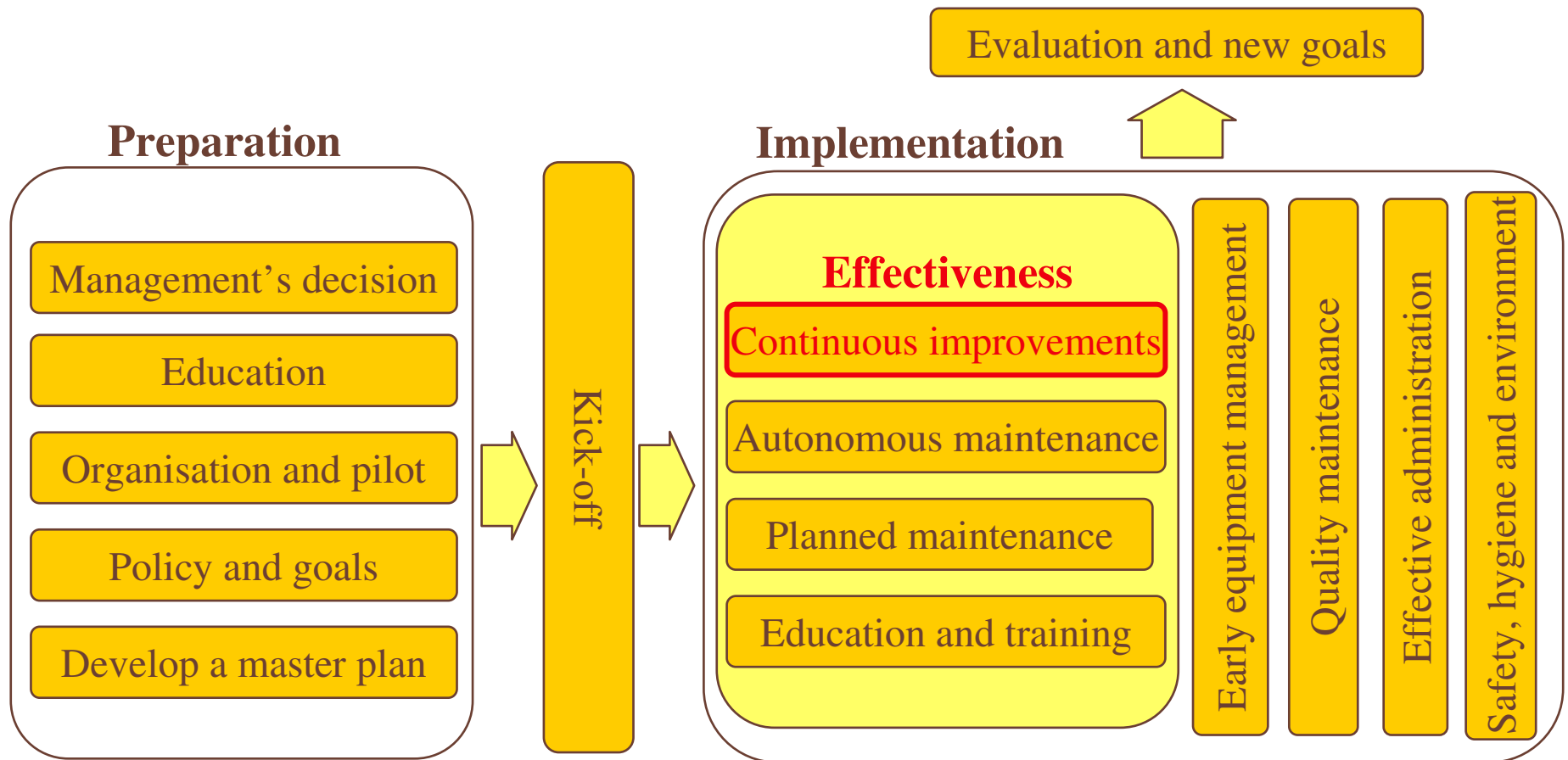


TPM Structure





TPM Structure



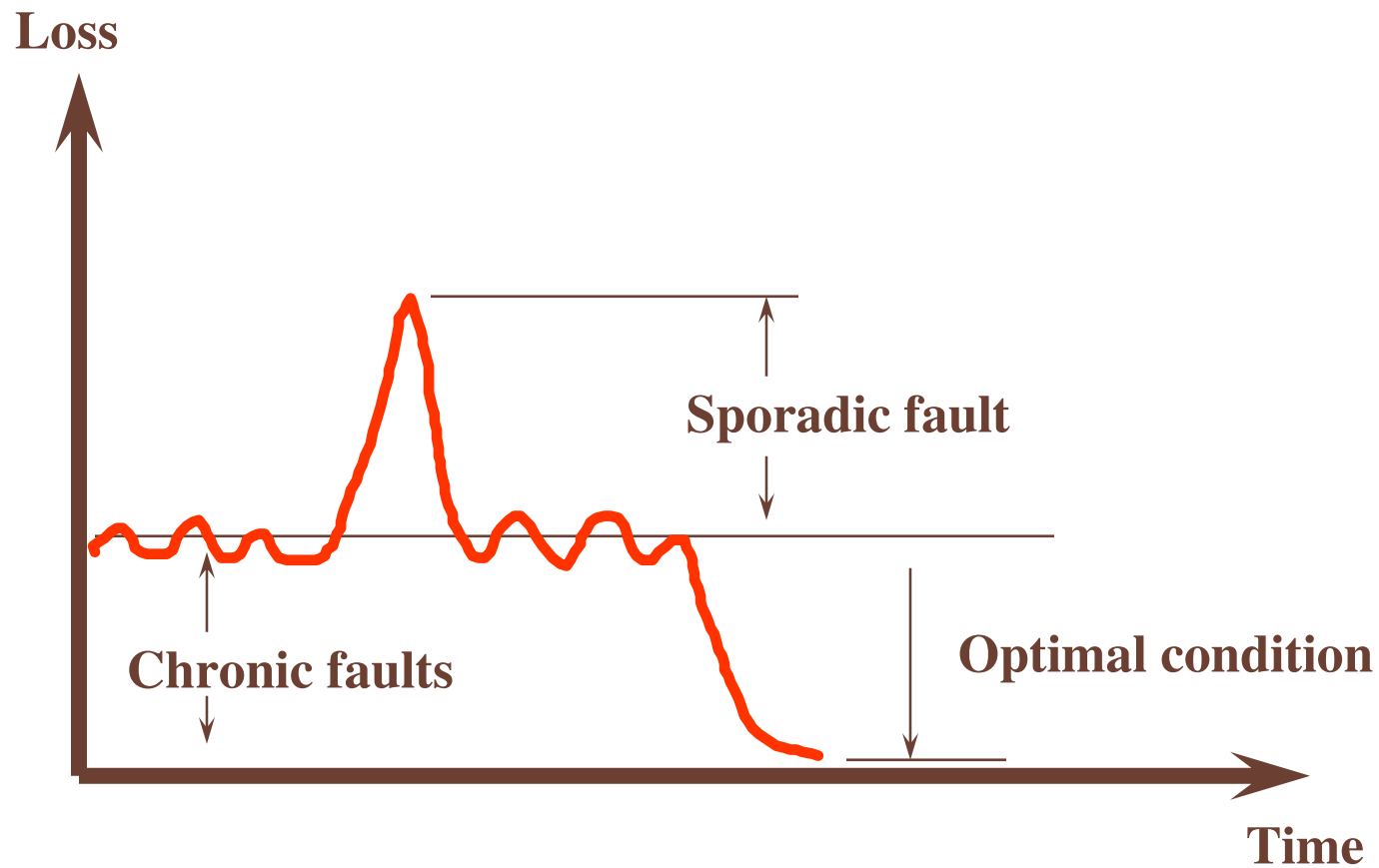


The six big losses

- Failures and break-downs
- Set-up and adjustments
- Idling and minor stoppages
- Reduced speed
- Defects and rework
- Start-up losses

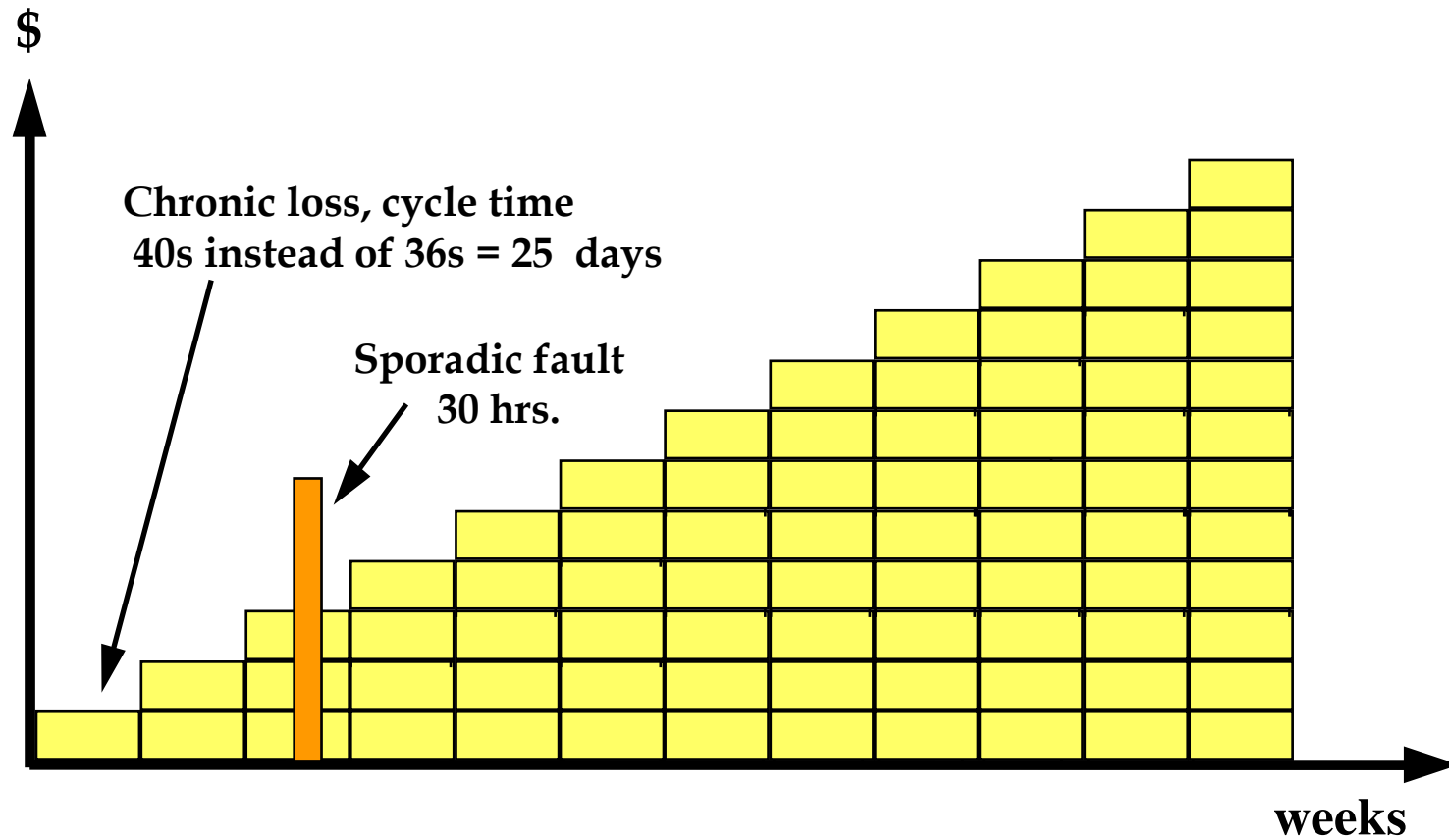


Sporadic and chronic losses



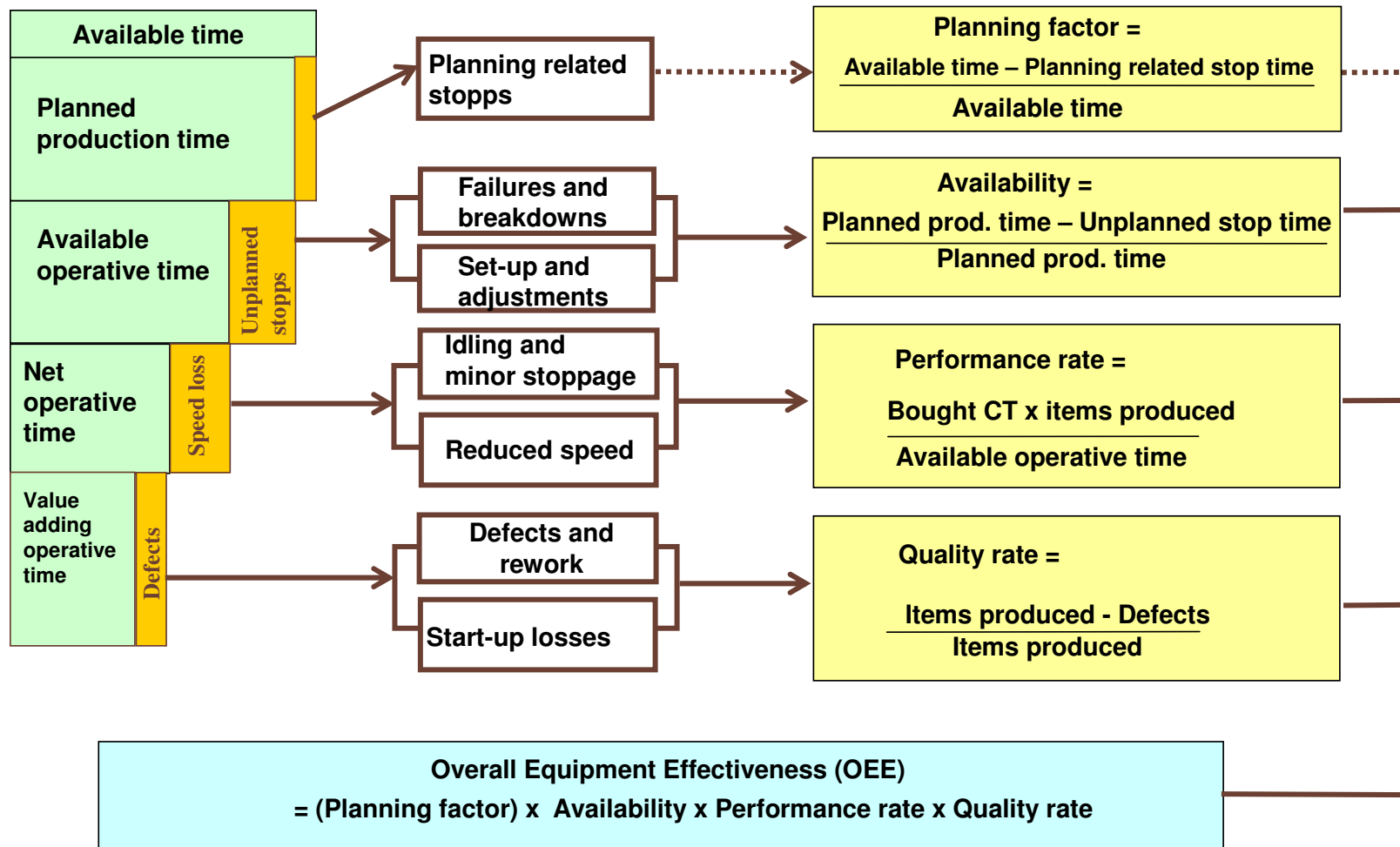


Sporadic and chronic losses



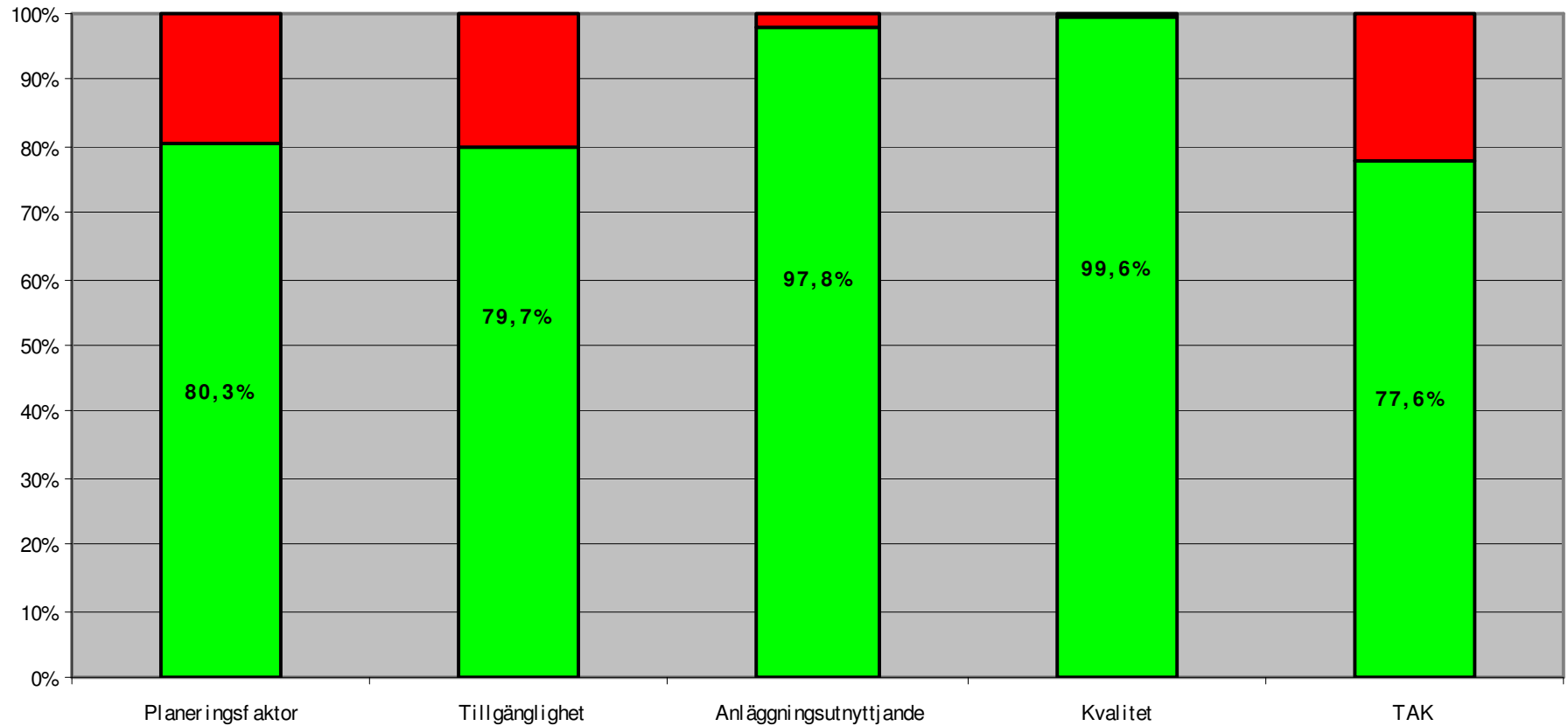


OEE calculations





OEE meassures

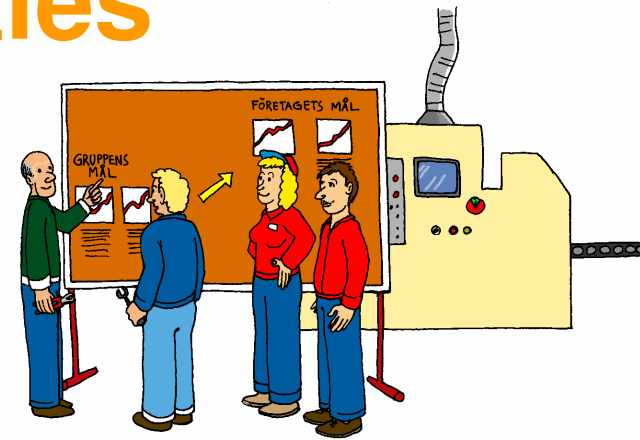




Group activities



Cross functional improvement group



Autonomous maintenance group



Target oriented cross functional group



Quality improvement tools

7QC/QM

Identify, prioritize and analyze failures

FMEA

Identify and evaluate potential weaknesses

FTA

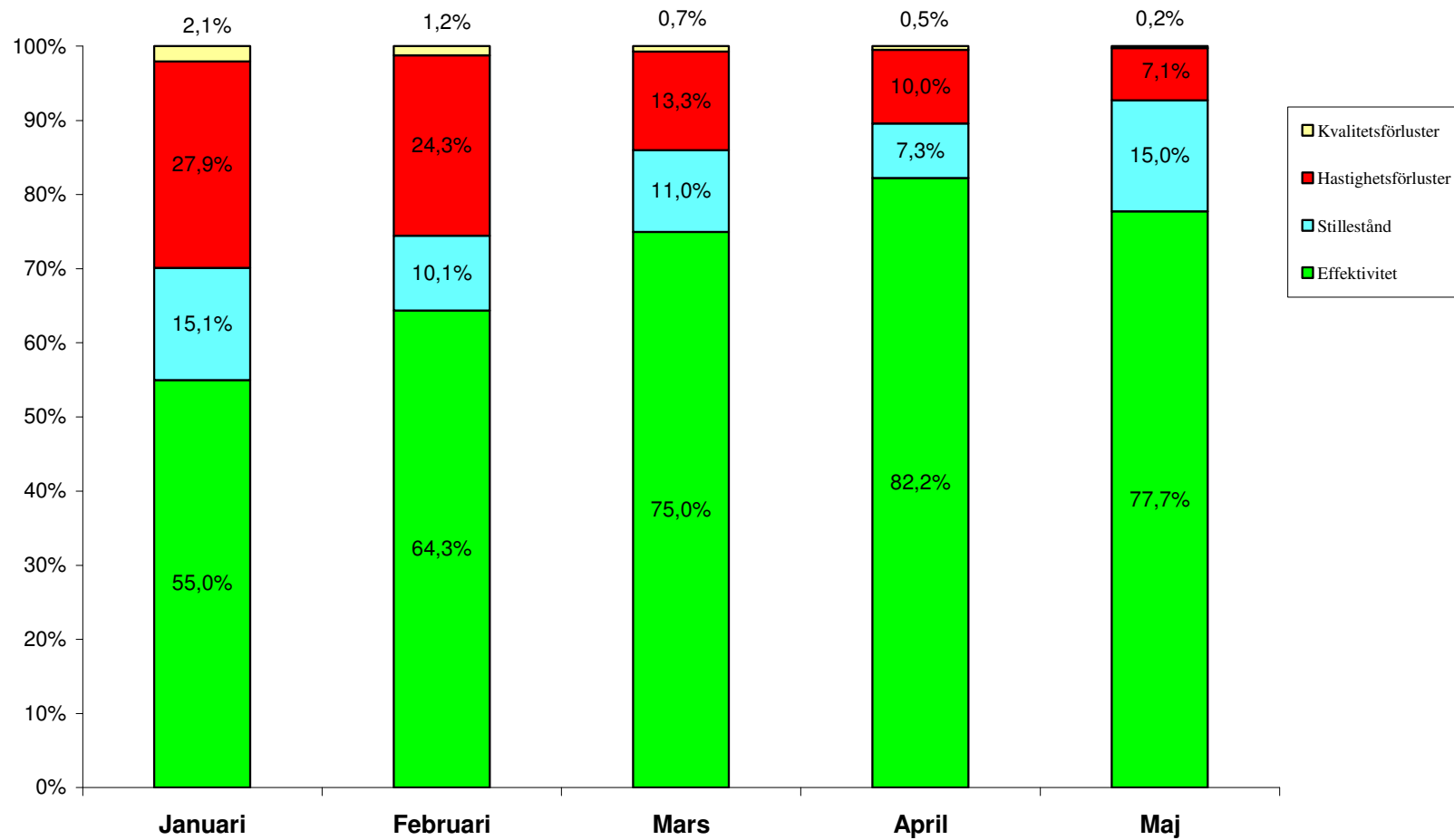
Identify causes of failures and their logic connections

PM-analysis

Reduce all chronic loss to zero

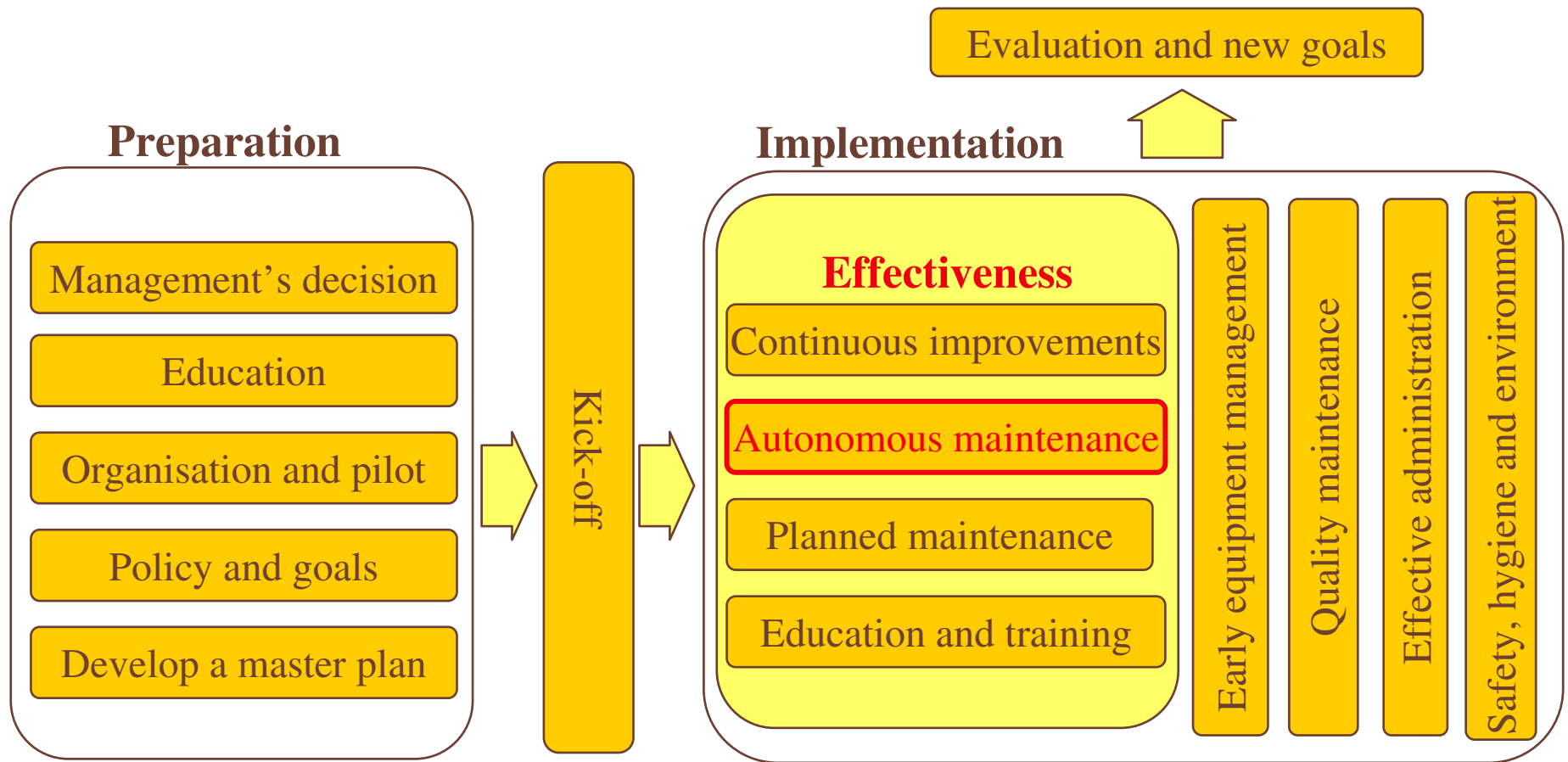


Example: ABB



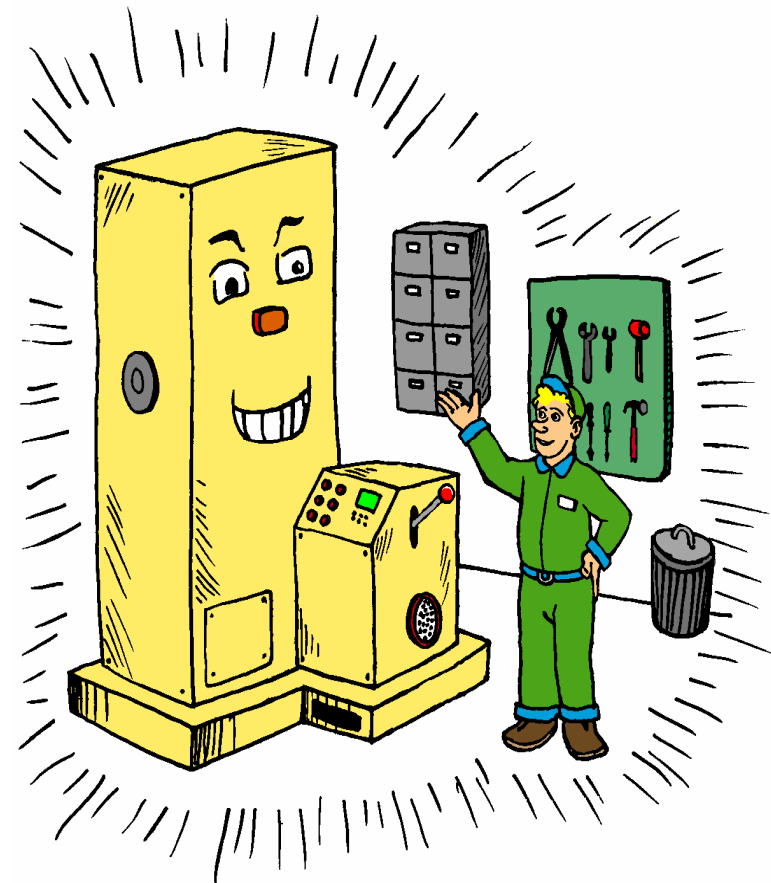
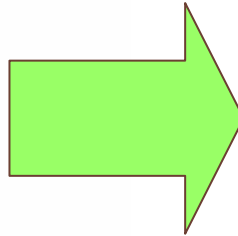
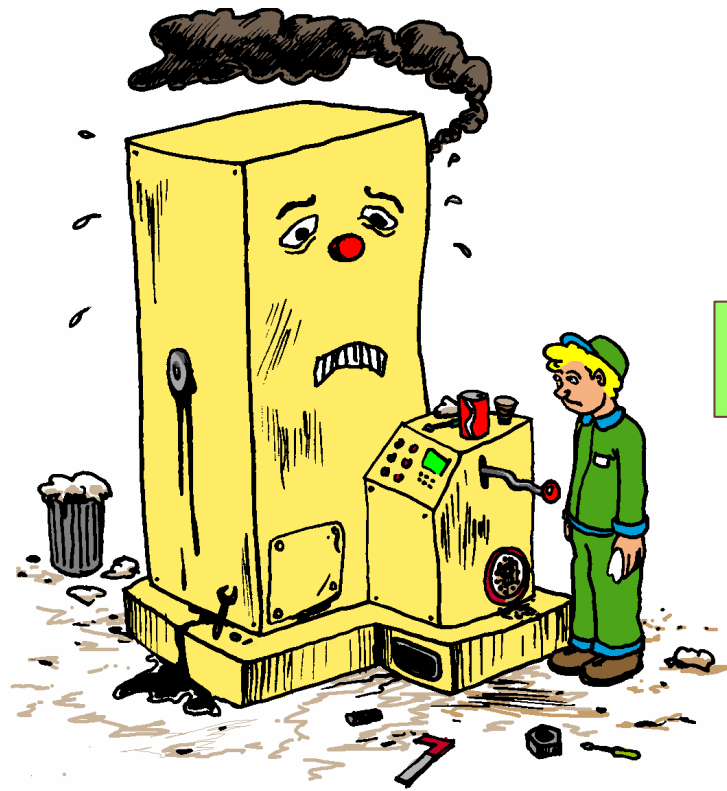


TPM Structure





Autonomous maintenance



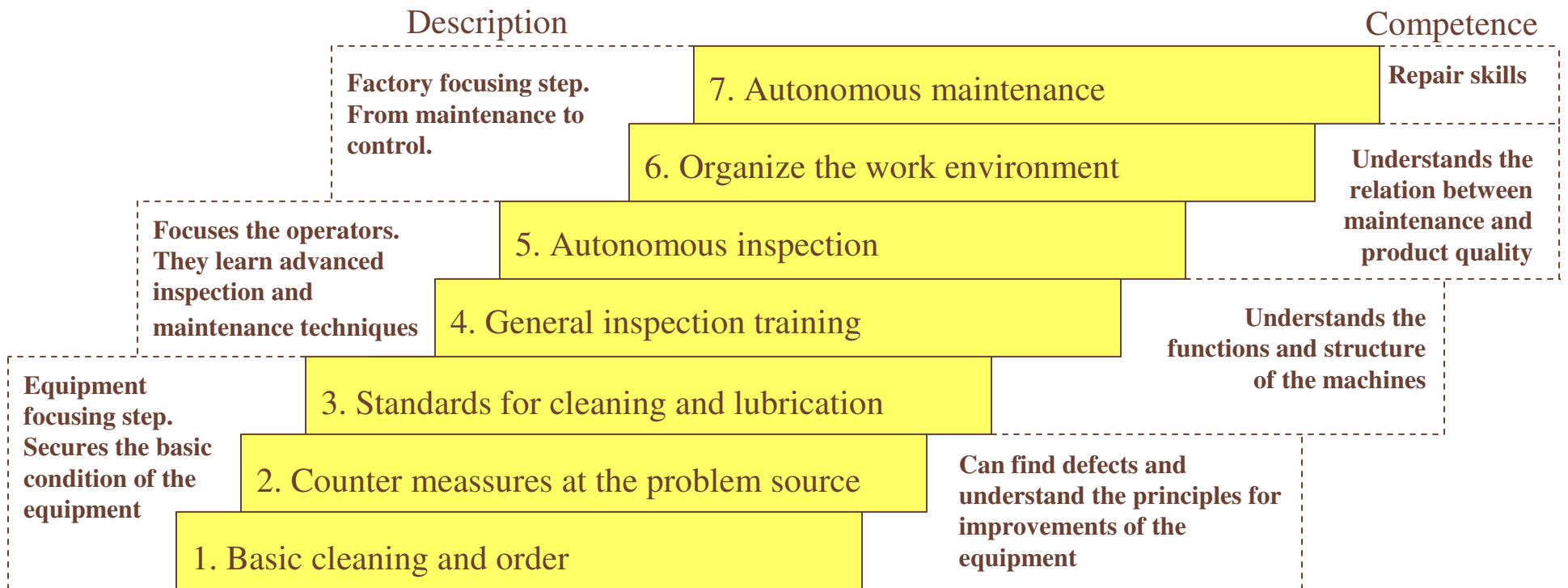


Autonomous maintenance

- Teach the operators to react on cause instead of result
- By increased competence and understanding the operators may:
 - Eliminate minor stoppages
 - Prevent break-downs
 - Secure implemented improvements
 - Improve quality, safety, and environment
- In the long run operators start to perform maintenance tasks
- Daily inspections replaces repair and low frequent controls
- Implemented through seven well-defined steps
- Takes long time to implement, often years

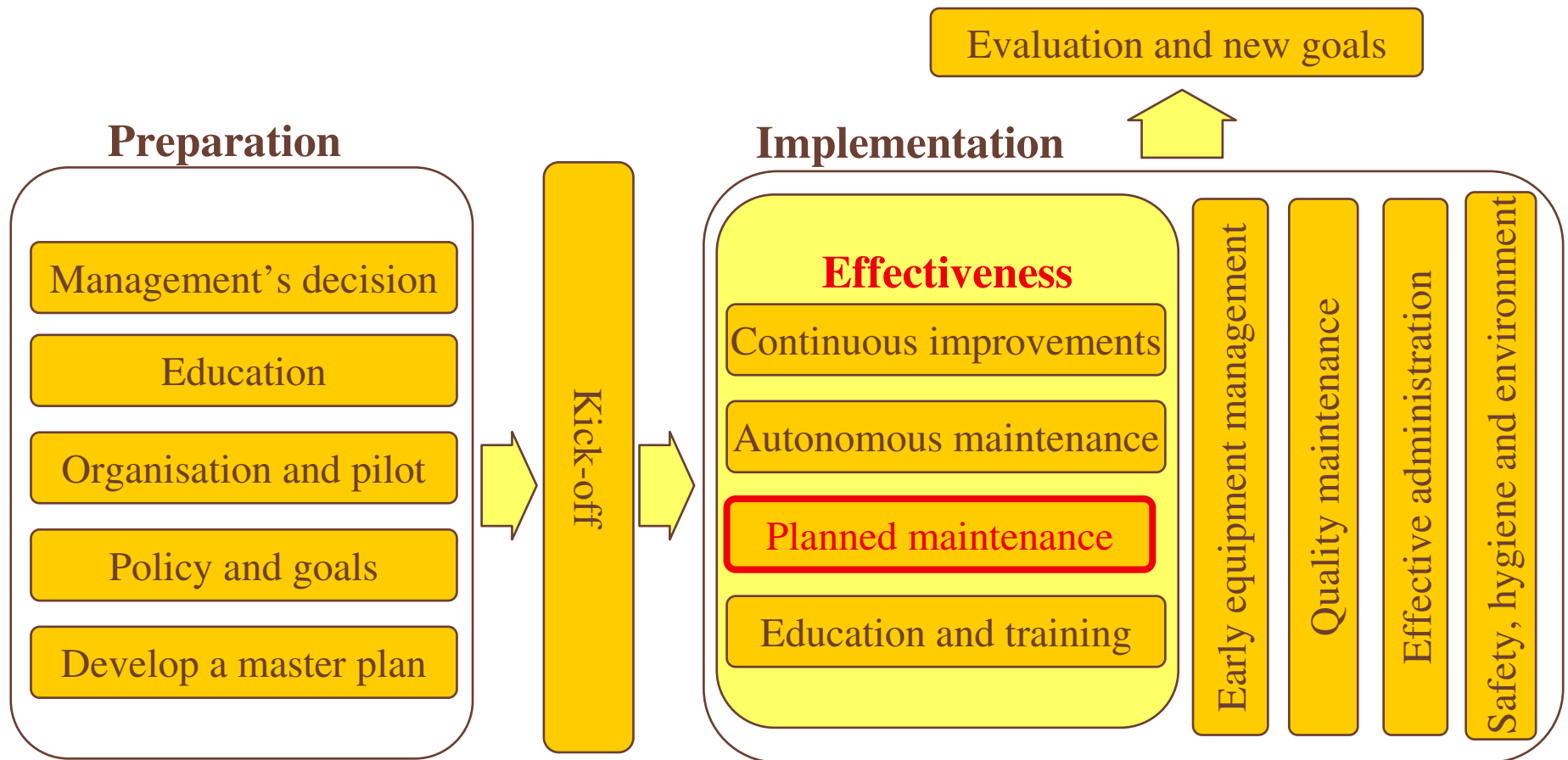


The seven-step ladder



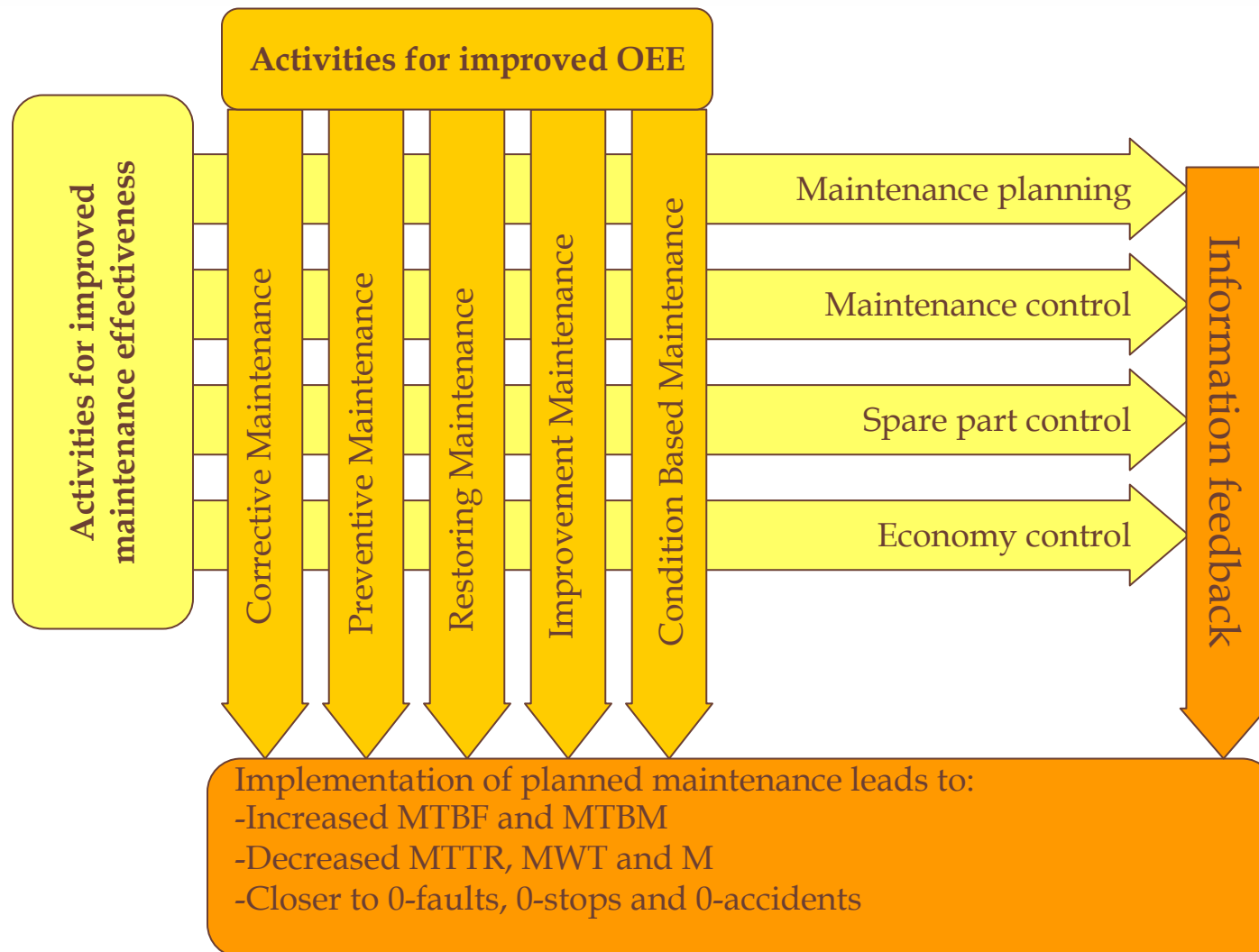


TPM Structure



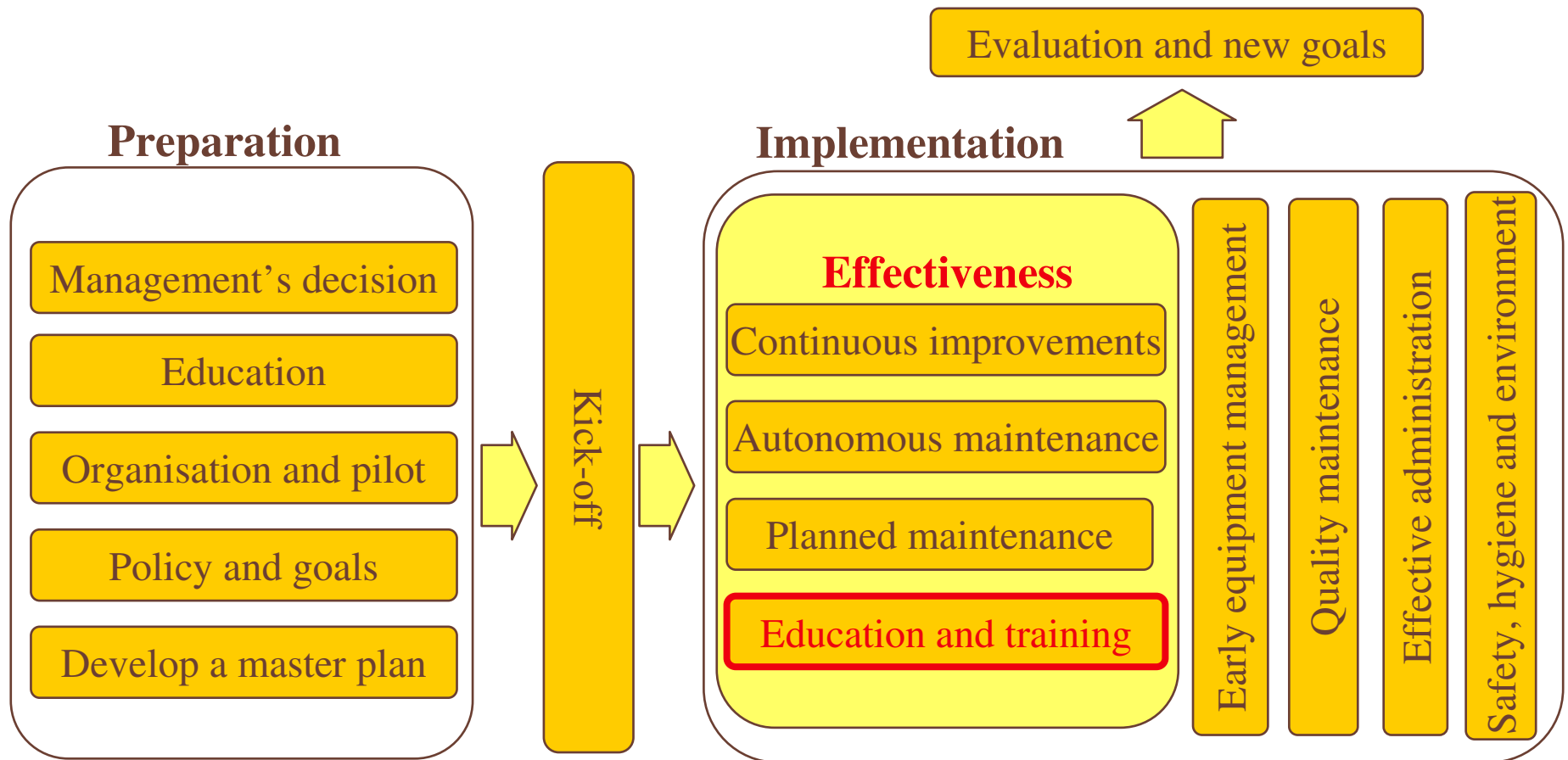


Planned maintenance



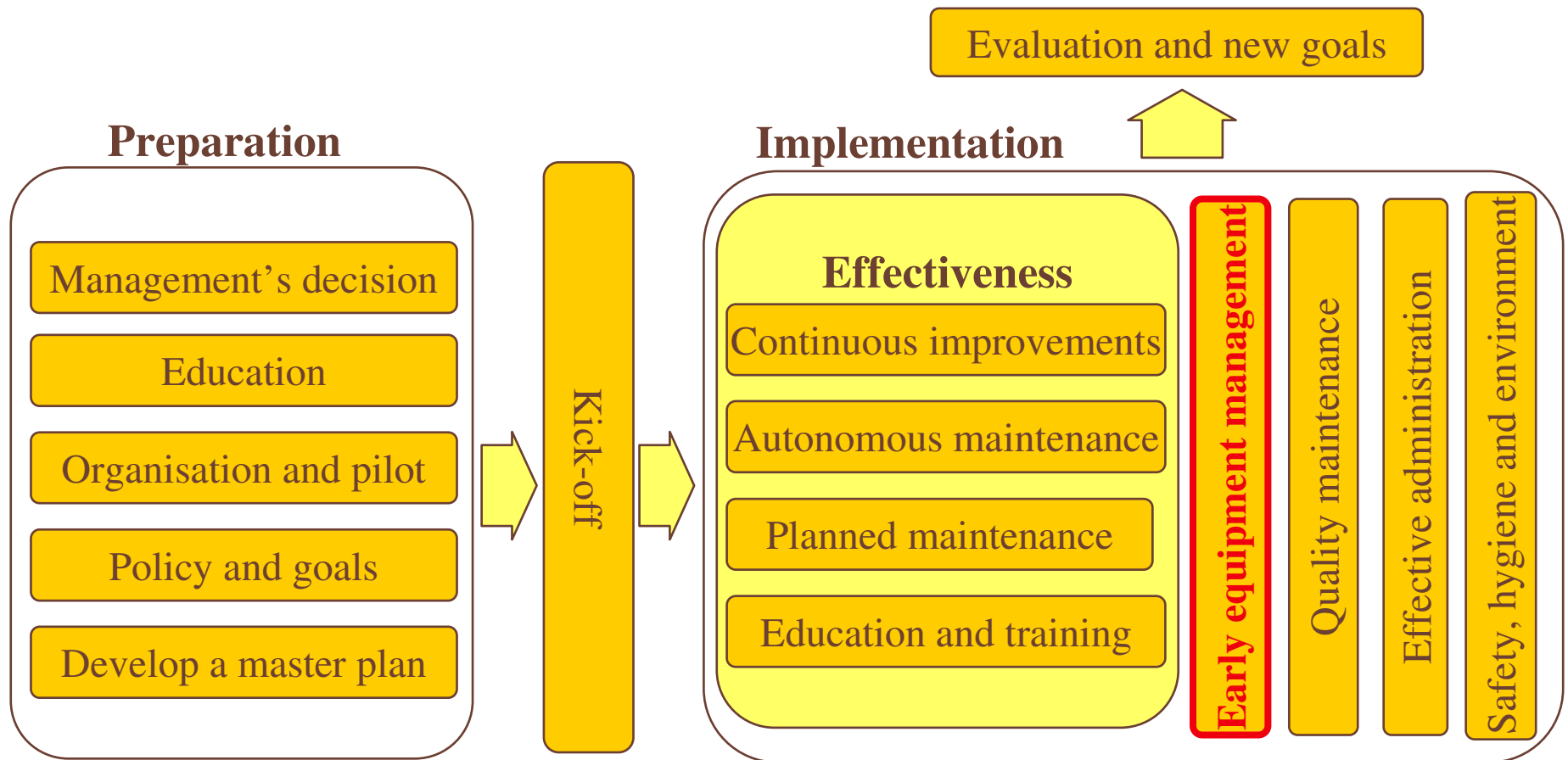


TPM Structure





TPM Structure

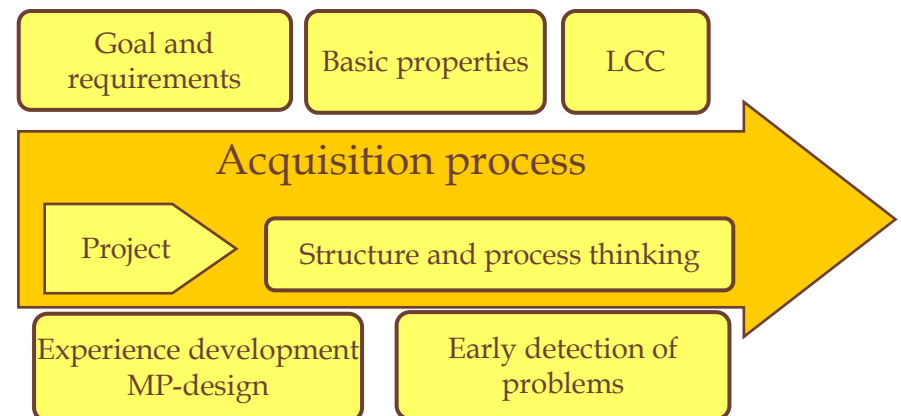




Early equipment management

The process has to goals:

- To reach stable, full speed production at start-up.
- To, as far as possible, meet the detailed requirements for the equipment.

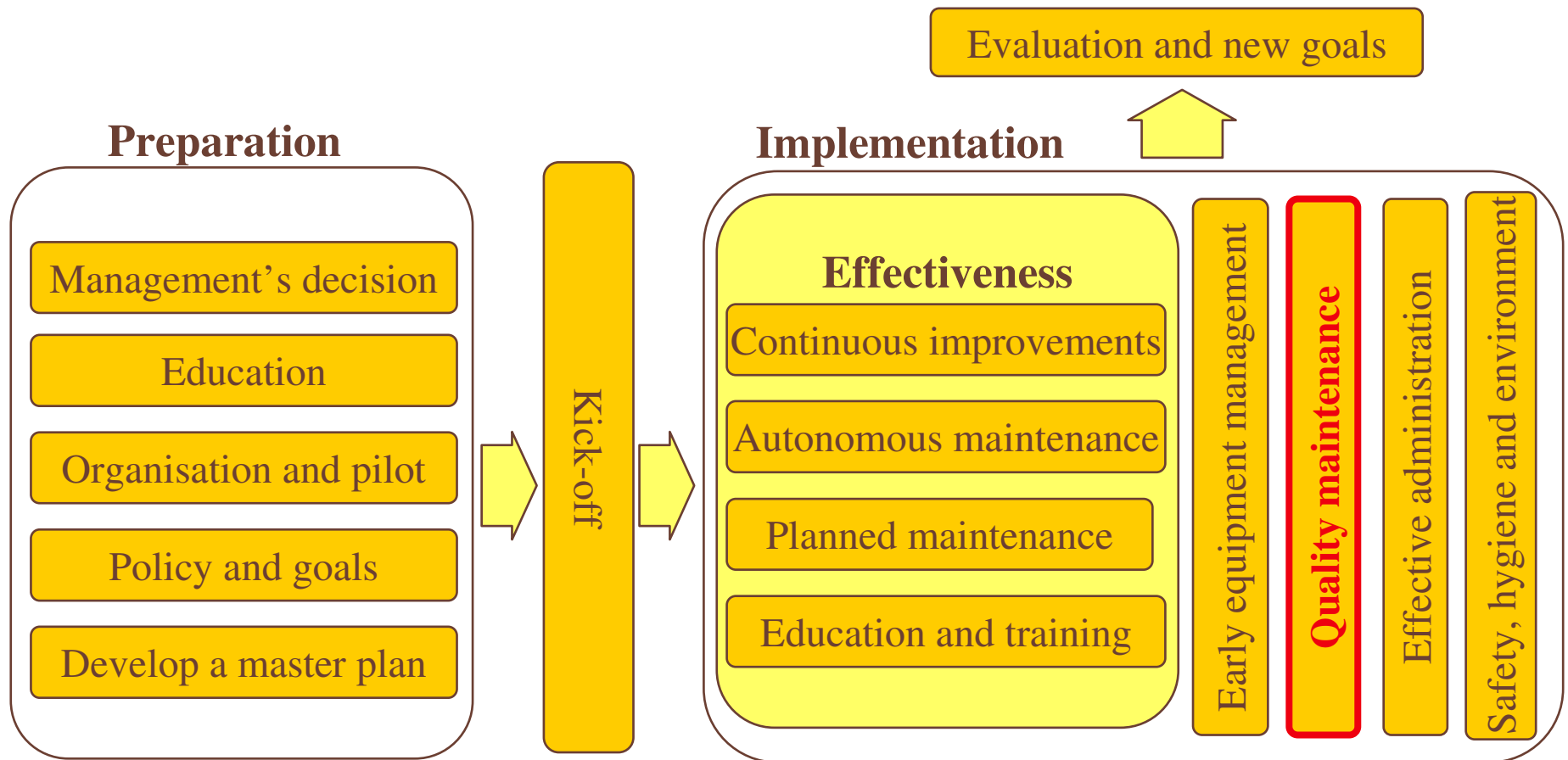


The included activities are aiming for new equipment to be:

- Reliable and producing non defective products.
- Easy to mend and set up, and fast to start after set-up changes.
- Easy to maintain, and fast to localize faults and repair.
- Easy to clean, lubricate and inspect.
- Resource efficient and safe.

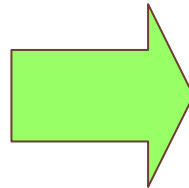
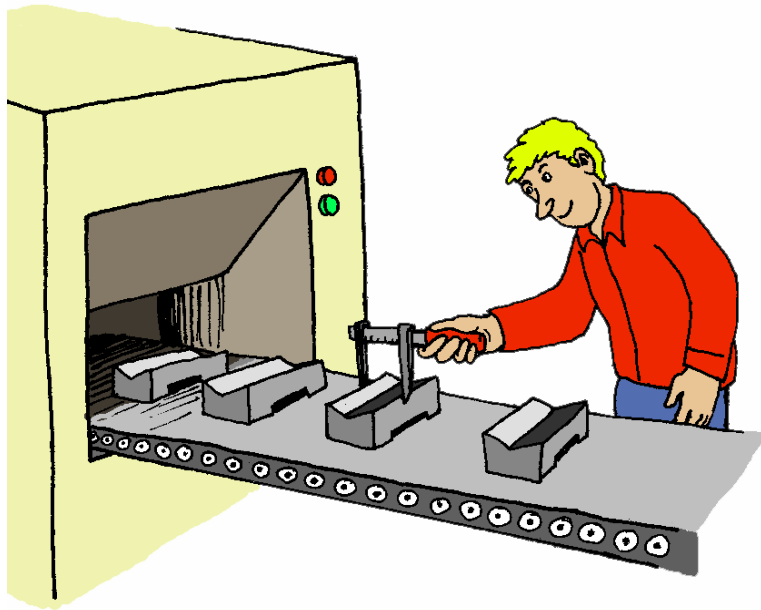


TPM Structure





Quality maintenance



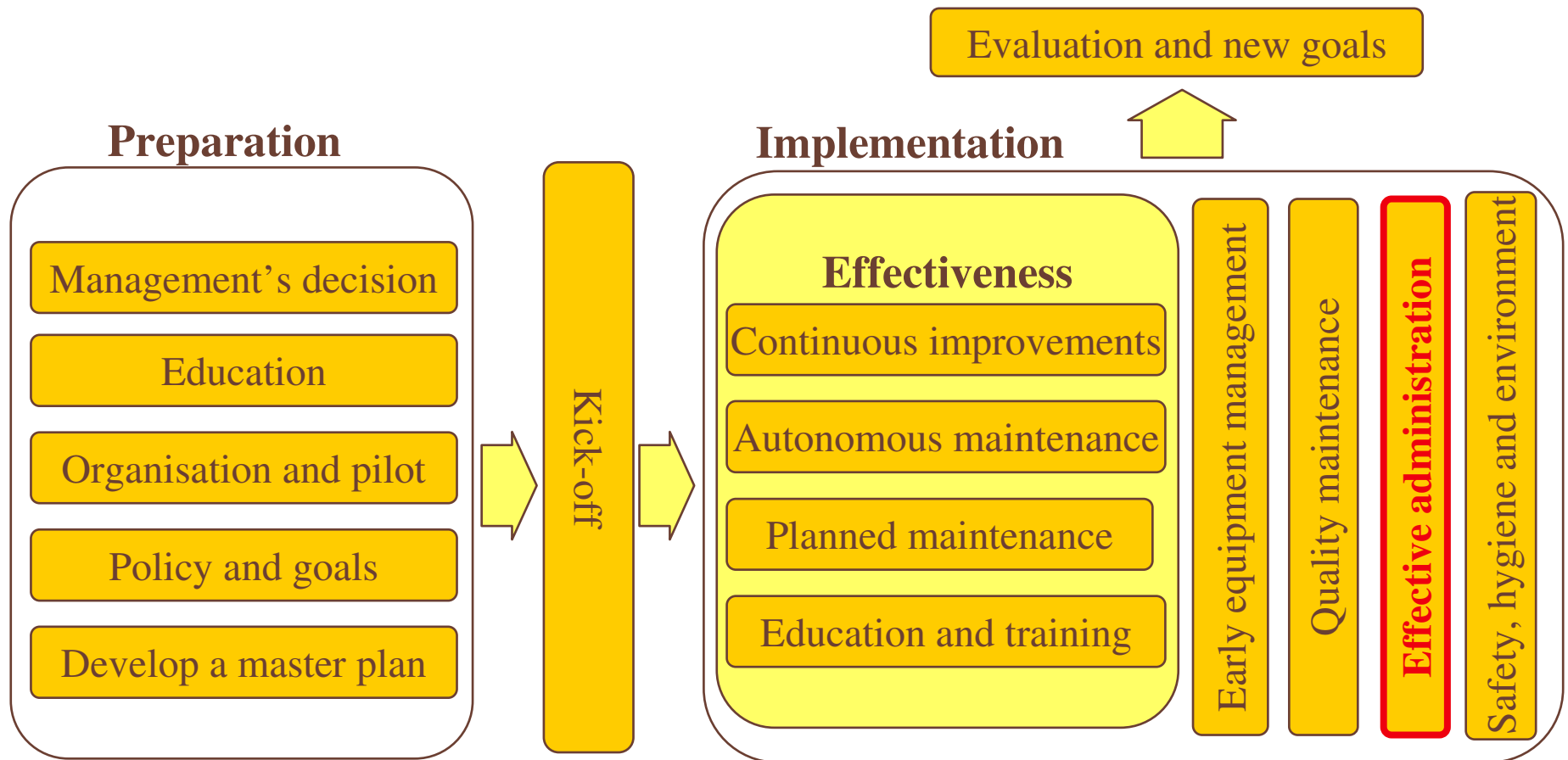


Quality maintenance in 17 steps

Phase 1	1	Control of quality standard and quality parameters
	2	Localizing origin of quality defects
	3	Choice of pilot equipment and defect for implementation of quality maintenance
	4	Evaluate function, operating state and method for set-up change of equipment
	5	Examine and restore the state of the equipment
Phase 2	6	Perform PM-analysis
	7	Eliminate all defect creating factors
	8	Define preferred state and optimize operating conditions and method for set-up change
Phase 3	9	Detect defects
	10	Restore or improve
	11	Evaluate standard values and which components to inspect
	12	Determine the valid state for production of non-defective products
	13	Reduce the number of inspection points
Phase 4	14	Define standard values for inspection points
	15	Make a draft for a quality matrix
	16	Discuss the content of the inspection standard
	17	Evaluate and, if needed, change the standards and inspection points through trend analysis



TPM Structure



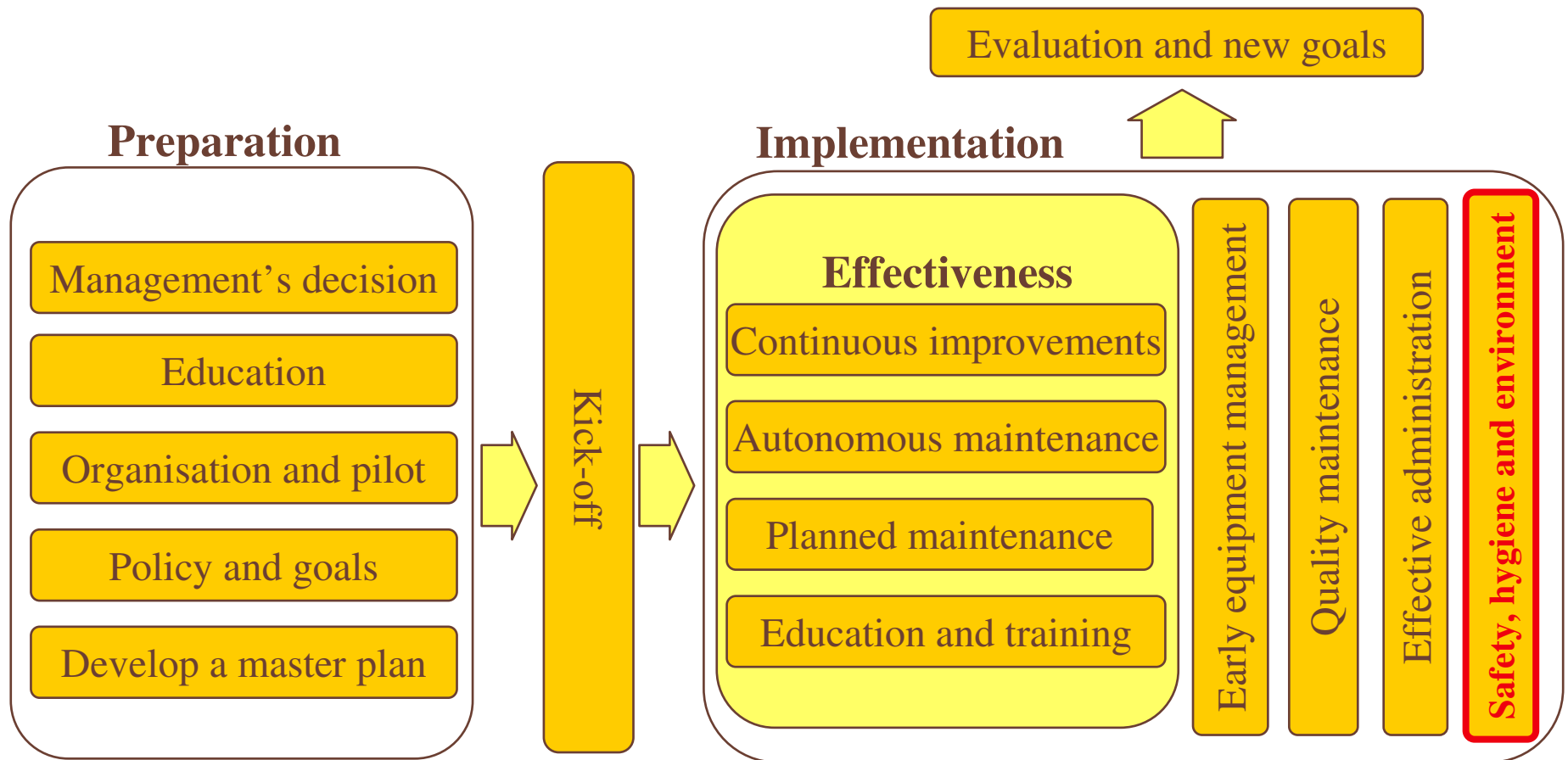


Effective administration

- The aim is to create effective administrative processes through:
 - Reduce loss and waste
 - Develop a work process that can handle change
- The goal is that all efforts aim at value creating tasks from the customers point of view (external and internal)
- Resembles "Autonomous maintenance" but in a different context
- Adds credibility to the organization by using the same tools as in the production
- Implemented through seven steps



TPM Structure





TPM Structure

Evaluation and new goals

Preparation

Management's decision

Education

Organisation and pilot

Policy and goals

Develop a master plan

Kick-off

Implementation

Effectiveness

Continuous improvements

Autonomous maintenance

Planned maintenance

Education and training

Early equipment management

Quality maintenance

Effective administration

Safety, hygiene and environment





Results of TPM at Volvo

Productivity	Breakdowns reduced with 90%
	OEE increased from 50% to 90%
	MTBF increased from 30 minutes to 8 hours
Quality	Scrap reduced with 90%
	Cost of quality control reduced with 67%
	Customer complaints reduced with 75%
Costs	Production cost reduced with 30%
Delivery precision	Capital bound in WIP and finished goods decreased with 50%
	Fulfillment actual/desired delivery time increased to 90%
	Delivery precision actual/promised time increased to 100%
Safety	Accidents resulting in personal injuries reduced to 0
	Accidents resulting in pollution reduced to 0
Commitment	Ten times as many suggested improvements
	Time for education and training increased with 100%