Module: **Total Productive Maintenance**

Element: **Overall Equipment Effectiveness**

Aims and Objectives

Target Audience :

Engineering, Maintenance, Facilities, Operations.

Purpose of Module :

To understand the key reasons for equipment losses by measuring performance effectively.

Aims & Objectives :

- Understand the 6 Big Losses
- How the Lean Toolbox can be used
- OEE as a measure of performance

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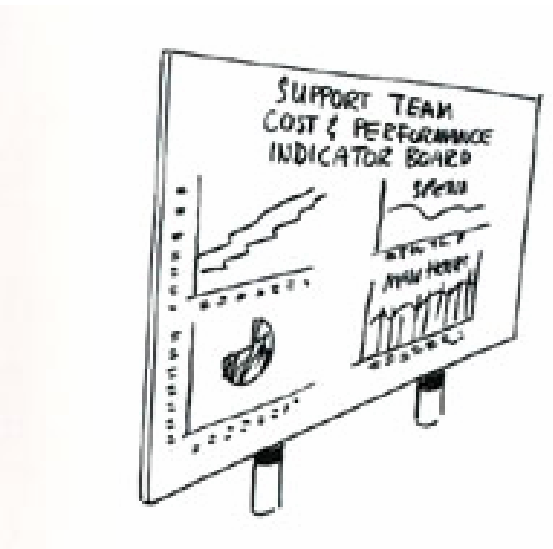
- **Introduction**
- **Overall Equipment Effectiveness Overview**
- **Measuring OEE / 6 Big Losses**
- **Data Collection**
- **How to Eliminate Losses**
- **What are the benefits?**

What is OEE ?

Overall Equipment Effectiveness (OEE) is a total measure of performance that relates the availability of the process to the productivity and quality



What does that mean ?

OEE is a Key Performance Indicator (KPI) that can measure the impact of change on a process caused by eliminating process, or equipment losses

Why is OEE so important ?

- If you were told that your department was running flat out you might reasonably assume that the equipment was running efficiently and effectively.
- What if the equipment only ran for 75% of the time?
- What if when it ran it ran at 80% of its speed ?
- What if only 90% of the parts it made are good?
- Individually these performance measures seem to indicate an OK piece of equipment, but is it a true picture?
- What’s impacting on these performance figures?

How do I measure OEE?

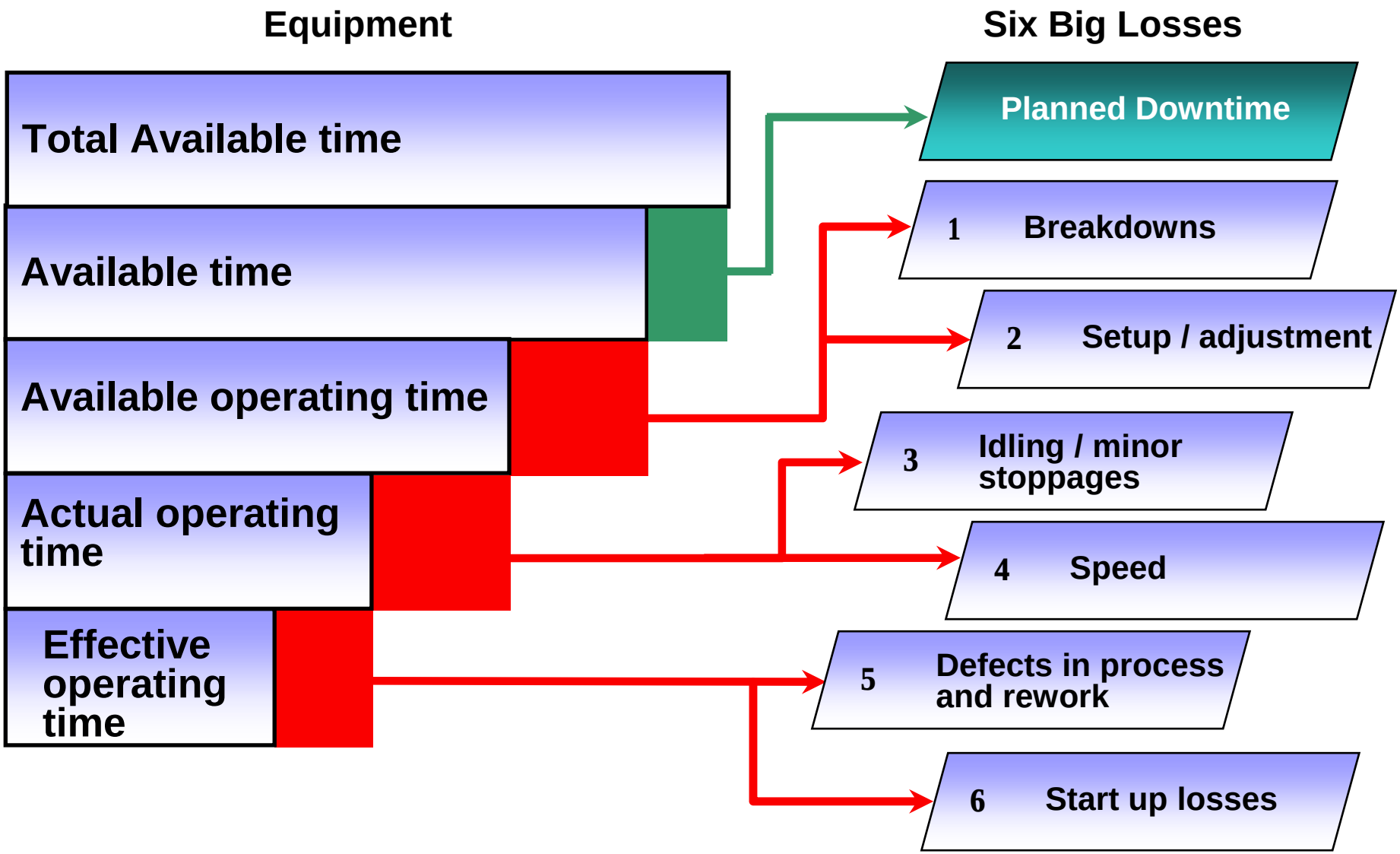
OEE =

AVAILABILITY

x PRODUCTIVITY

x QUALITY

OEE and the Six Big Losses



Availability

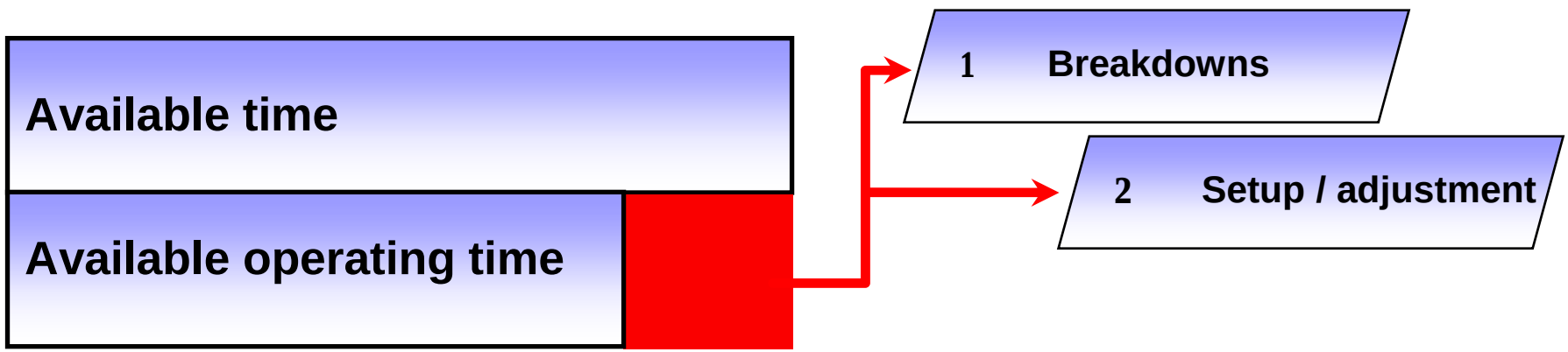
"The percentage of time equipment is actually running *when we need it*"

AVAILABILITY= $\frac{\text{AVAILABLE TIME – UNPLANNED DOWNTIME}}{\text{AVAILABLE TIME}}$ ***x 100%***

Where:-

Available Time = Total Available Time – Planned Downtime*

***Note :- Planned Downtime could be PM, no scheduled work, breaks, etc.**



Planned v Unplanned Downtime

- **Planned**
  - Excess capacity.
  - Planned breaks.
  - Planned Maintenance.
  - Communications briefs / team meetings.

- **Unplanned (Losses)**
  - Breakdowns.
  - Set Ups and Adjustments.
  - Late deliveries (material).
  - Operator availability.

Note :

Planned time such as breaks, meetings and maintenance can be considered as losses (useful for encouraging ideas on how to minimise their disruption) as long as a consistent approach is taken.

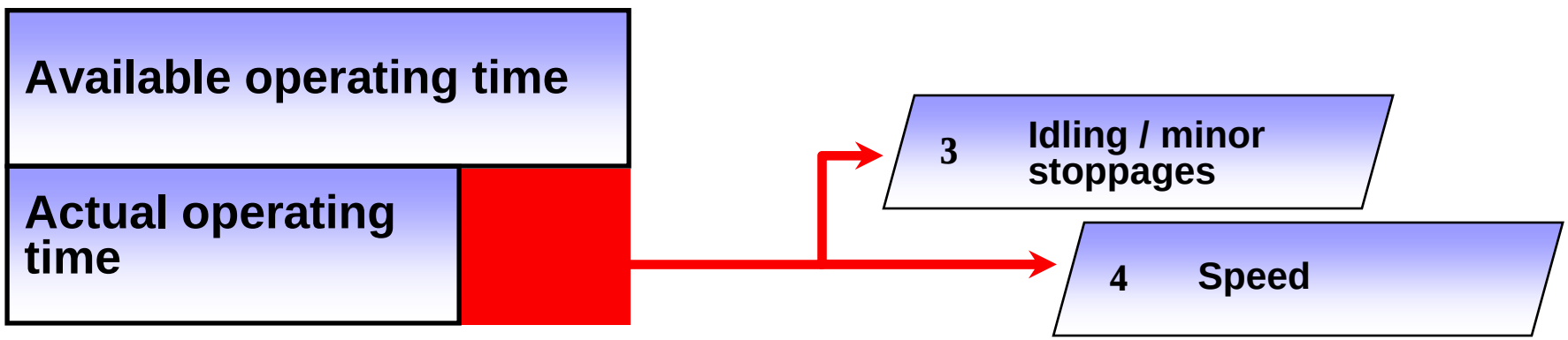
Productivity

"The difference between the potential output and actual output, *when the equipment was available*"

PRODUCTIVITY = IDEAL CYCLE TIME x ACTUAL OUTPUT* *x 100%*

AVAILABLE OPERATING TIME

Note :- Actual Output is the Quantity of good & bad parts



Operating Speed v Productivity

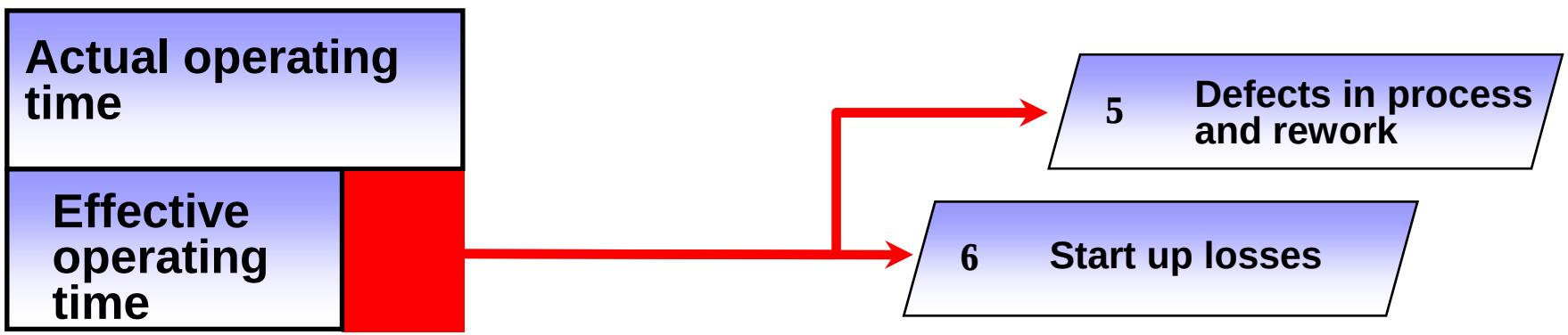
- **Operating Speed Rate**
  - The % of actual cycle time against ideal cycle time.

- **Productivity**
  - The Operating Speed Rate factored with interruptions to constant processing, i.e. idling and minor stoppages.

Quality

“The total good parts produced expressed as a % of the total parts produced”

QUALITY= $\dfrac{\text{PARTS MADE – DEFECT QUANTITY}}{\text{PARTS MADE}} \times 100\%$

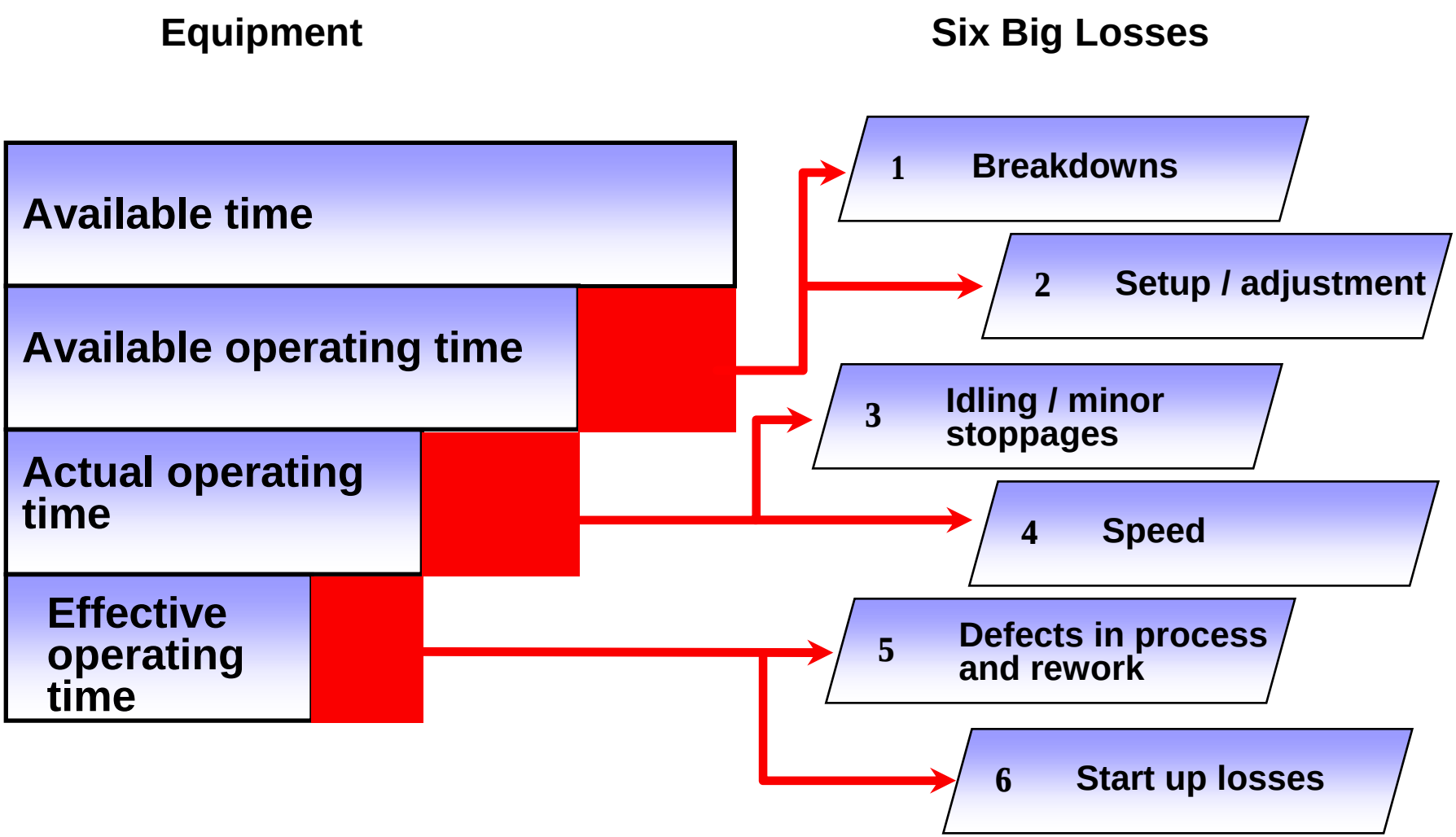


Processed v Defect Quantity

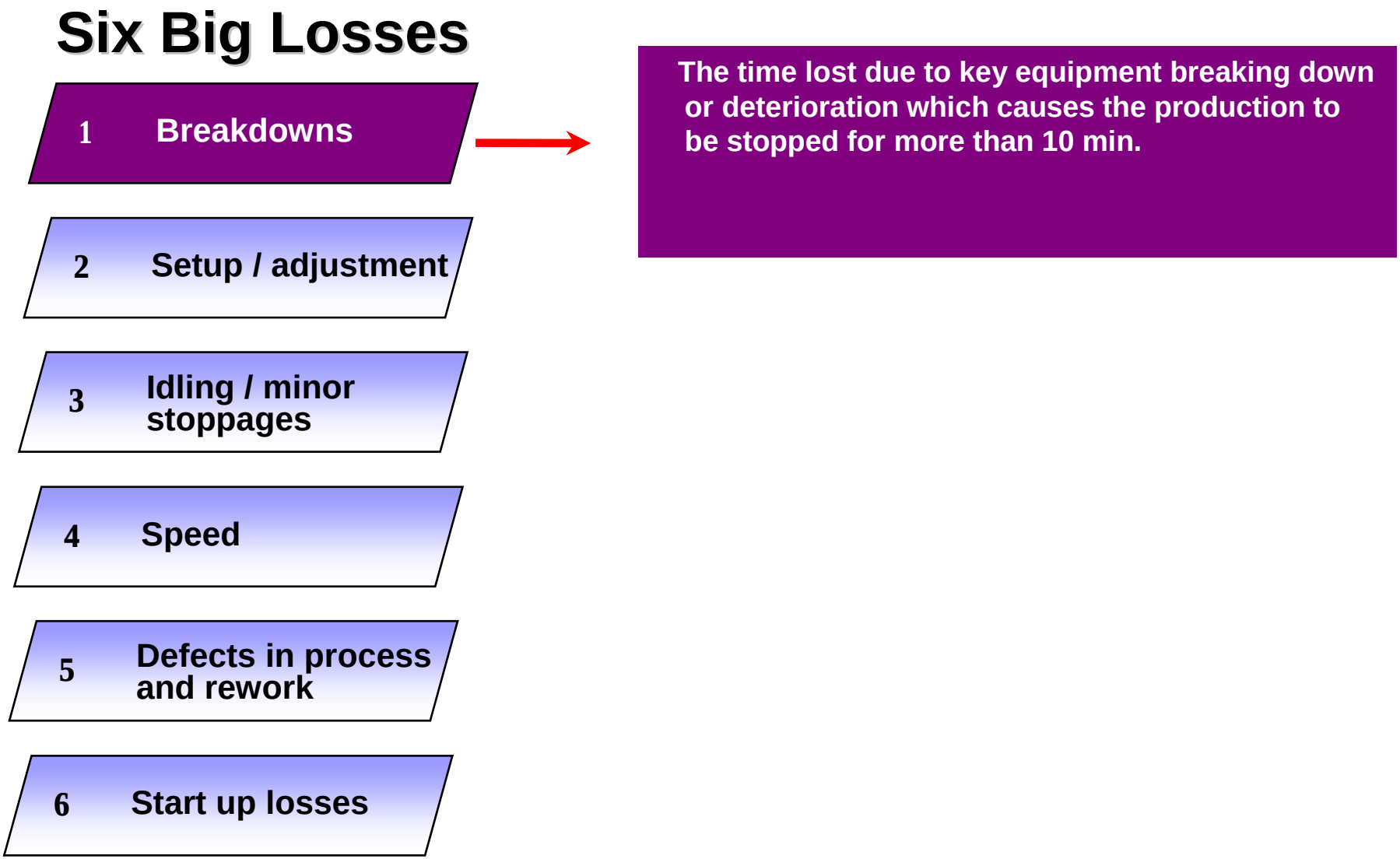
- **Parts Made**
  - The total quantity of parts produced in the available time.

- **Defect Quantity**
  - The quantity of parts that did not meet the required standard (including rework) in the available time.

OEE and the Six Big Losses



Six Big Losses - What Are They ?



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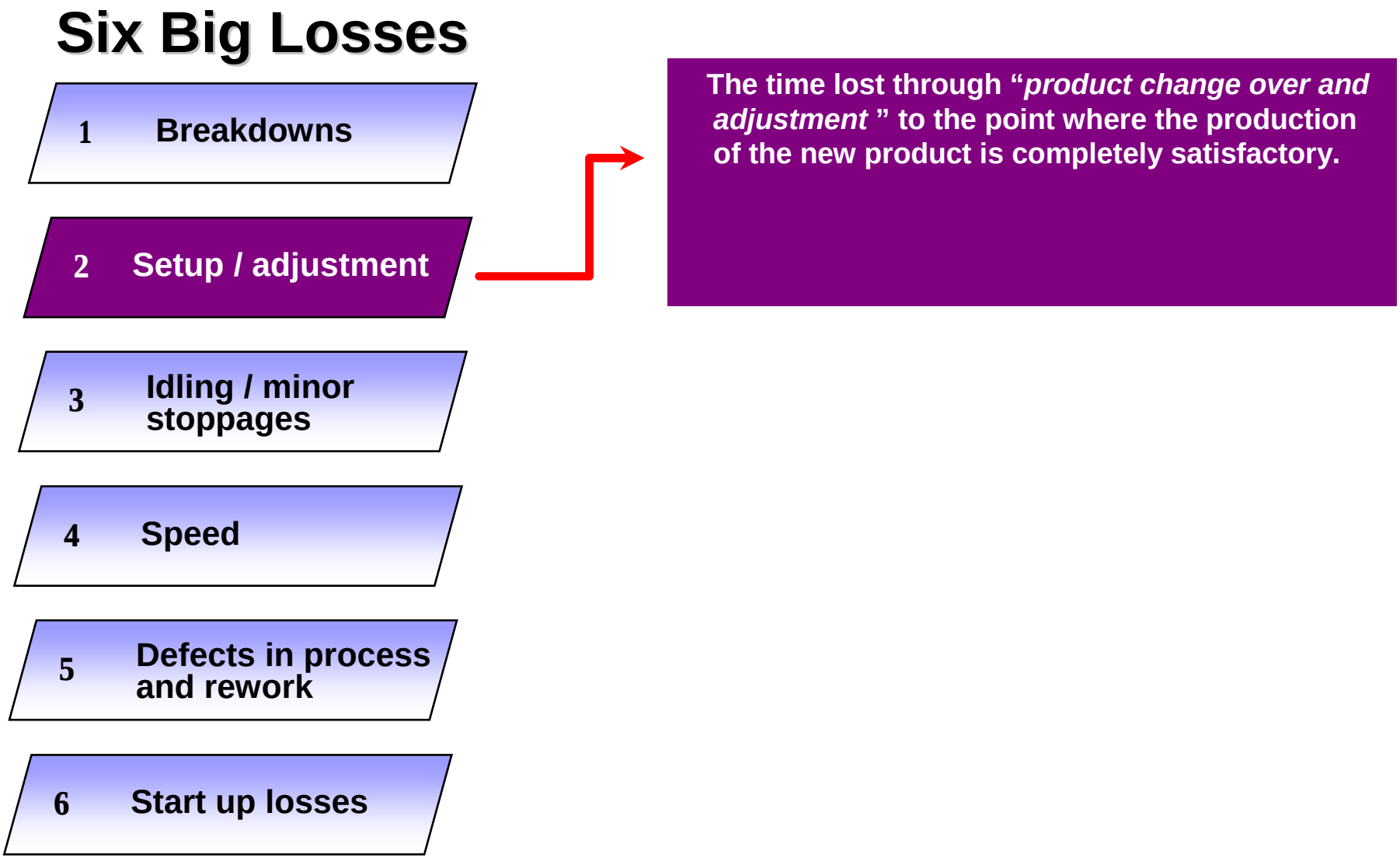

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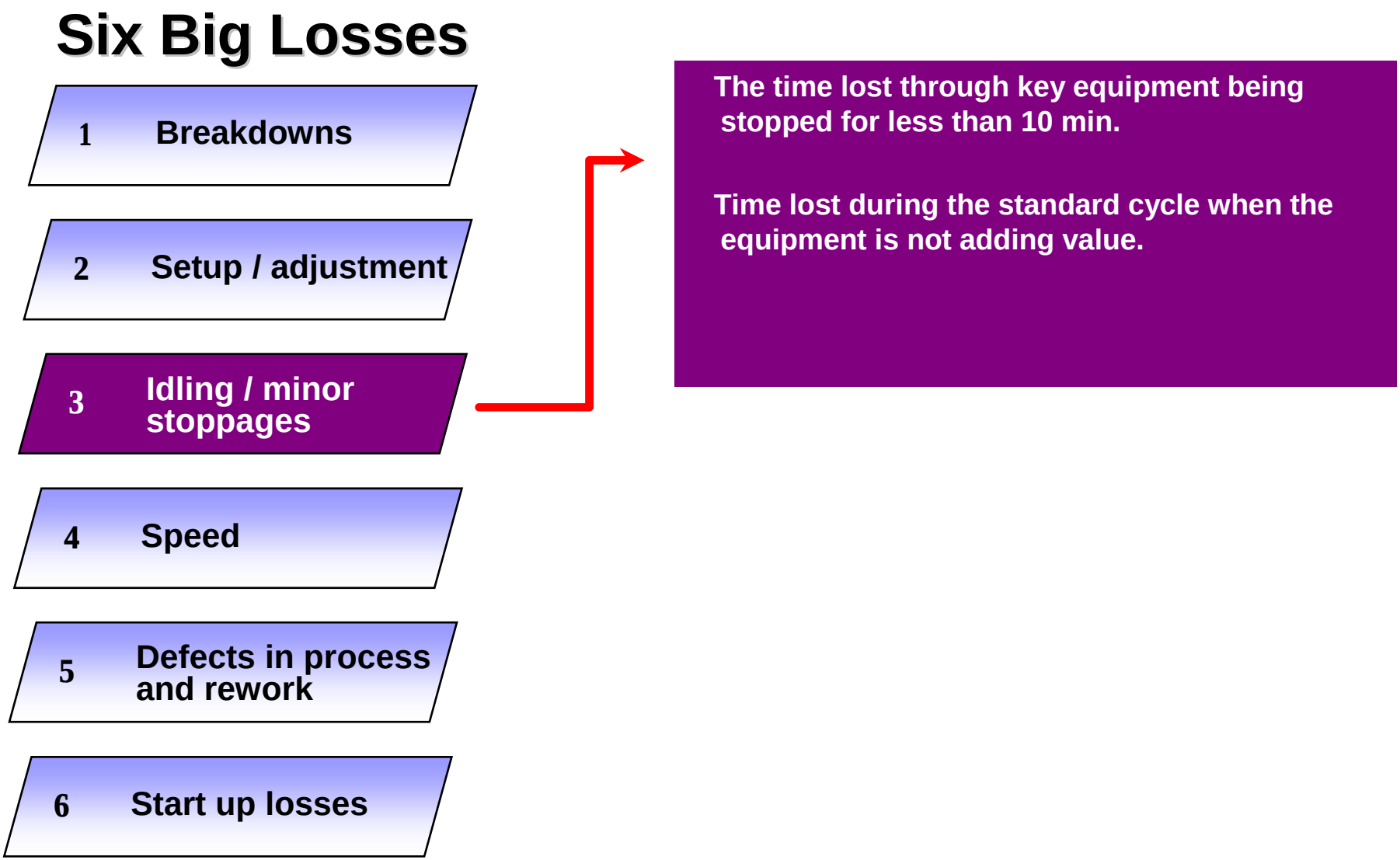

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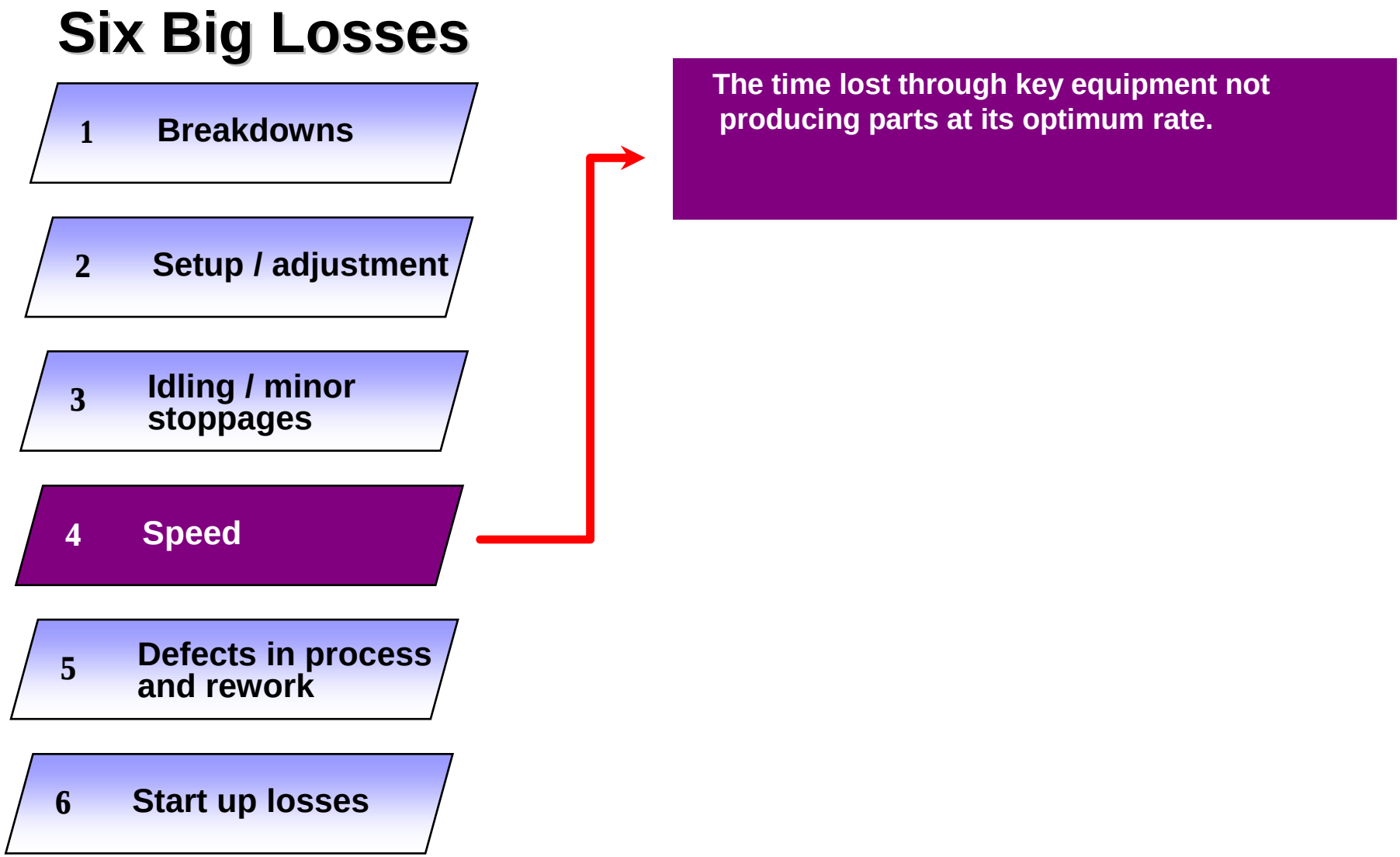

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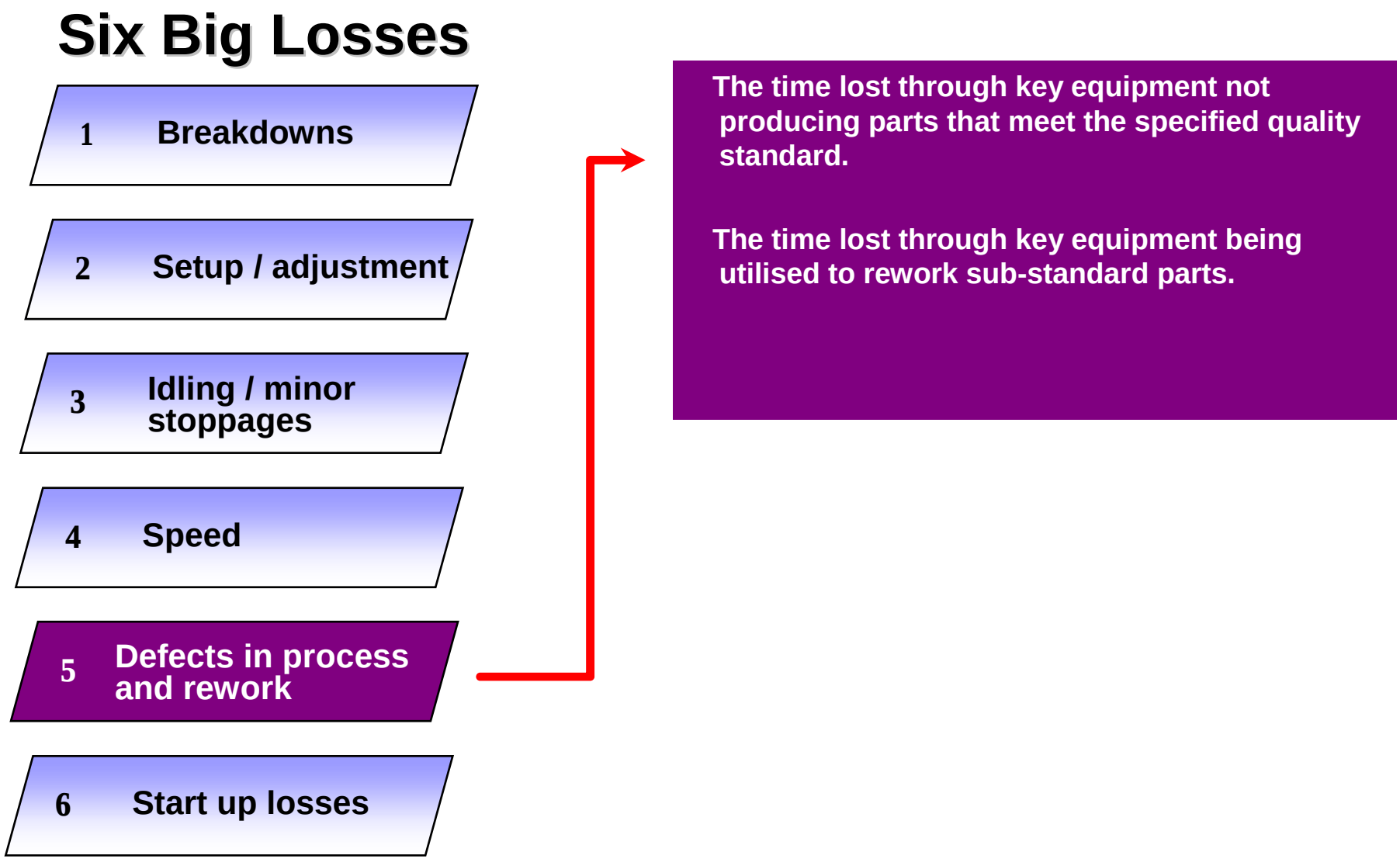

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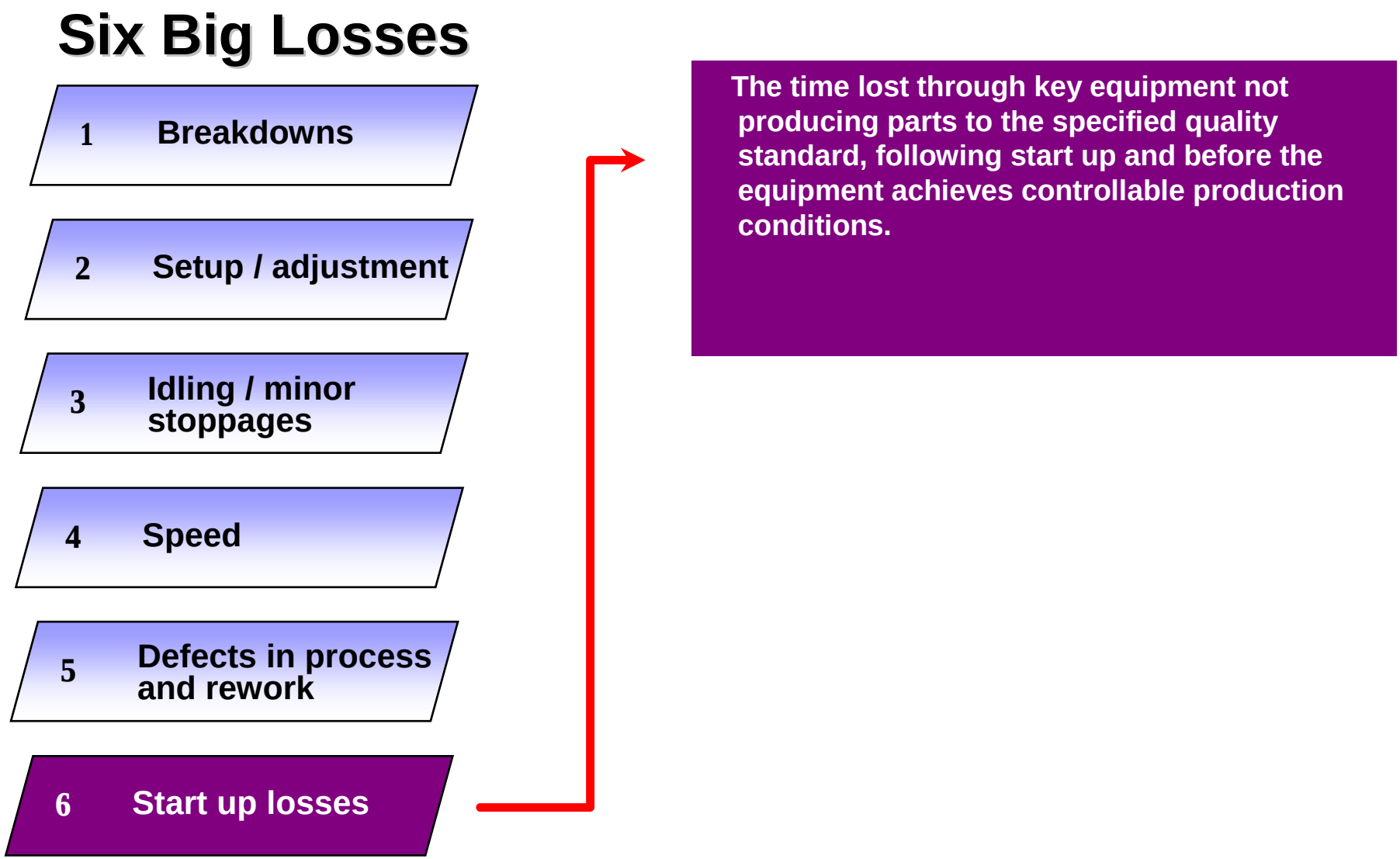

How to collect data for OEE

- **Key Points**
  - OEE is a measure of the equipment or process, not the operators productivity.
  - Keep it simple.
  - Ensure the process of measuring and applying OEE involves the people who use the equipment.
  - Make data collection second nature not a hindrance.
  - Understand the process.
  - Obtain the data on fixed frequency.
  - Snap shot v continuous.
  - Units of time (1 min, 10 mins, 30 mins, etc.).
  - Automatic or manual data collection.
  - Ownership.
  - Partnership – those completing sheets and those collecting/collating.
  - Regular communication of results.
  - Response to trends, peaks and troughs.

How to collect data for OEE

- **Example : Three Hourly Data Sheet**

Machine No.				No. operators				A B C D		Day / Night		Date /	
Hour of the Day	Tape No.	Machine Downtime											
		Programme change inc. test piece	Tooling problem - please specify cause	Machine problem - please specify cause	Cartridge Change	Calibration	Meetings (inc. team brief)	Clean up & SAP up	Post / fixture problem	Slaving Up	Other - please specify cause	Specified causes of machine downtime	Total Downtime every 3 hrs
7-8													
8-9													
9-10													
10-11													
11-12													
12-1													
1-2													
2-3													
3-4													
4-5													
5-6													
6-7													
TOTAL													

Hand Over Notes:

How to collect data for OEE

AVAILABILITY			
Gross Time		(in minutes)	A
Planned Down Time		(in minutes)	B
Net Available Time		(in minutes)	C=A-B
Non planned stoppages		(in minutes)	D
Operating Time		(in minutes)	E=C-D
AVAILABILITY			F = E/C
PRODUCTIVITY			
Output			G
Standard Cycle time		(mins/ unit)	H
PRODUCTIVITY			I= (HxG)/E
QUALITY			
Defect Quantity			J
QUALITY			K = (G-J)/G

How to Eliminate Losses ?

6 Big Losses

	Break-downs	Setup & Adjust	Idling & Minor Stops	Speed	Quality Defects	Start Up Losses
Continuous Flow Processing	✓					
Error Proofing					✓	✓
Quich Changeover		✓				
Standard Operations	✓	✓	✓	✓	✓	
Working Sequence	✓	✓	✓	✓	✓	
Visual Management	✓	✓	✓	✓	✓	
Andon	✓	✓	✓	✓		
Autonomous Maintenance	✓		✓		✓	✓
Effective Maintenance	✓	✓	✓	✓	✓	✓
Workplace Layout		✓				
Machine Design	✓	✓	✓	✓	✓	✓
5C	✓	✓				

How Do We Use OEE?

- OEE is only a measure, its benefits will be lost if the shortfalls it identifies are not acted upon.
- OEE is a total measure of performance but the data used to produce it must be used to prioritise improvement tasks.
- The purpose of measurement is to identify losses, remove waste and drive improvement.
- OEE should be used to support the Total Productive Maintenance (TPM) approach and the tools it supplies.

What are the benefits of OEE?

- **FOCUS**
  - Highlight priorities for change.
- **SIMPLICITY**
  - Even complex processes can be measured.
- **FEEDBACK**
  - Before and after change.
- **BENCHMARKING**
  - Objective comparisons.
- **TARGET SETTING**
  - Setting achievable goals.

Solving Problems