Think People before Tools

Free Webinar 80

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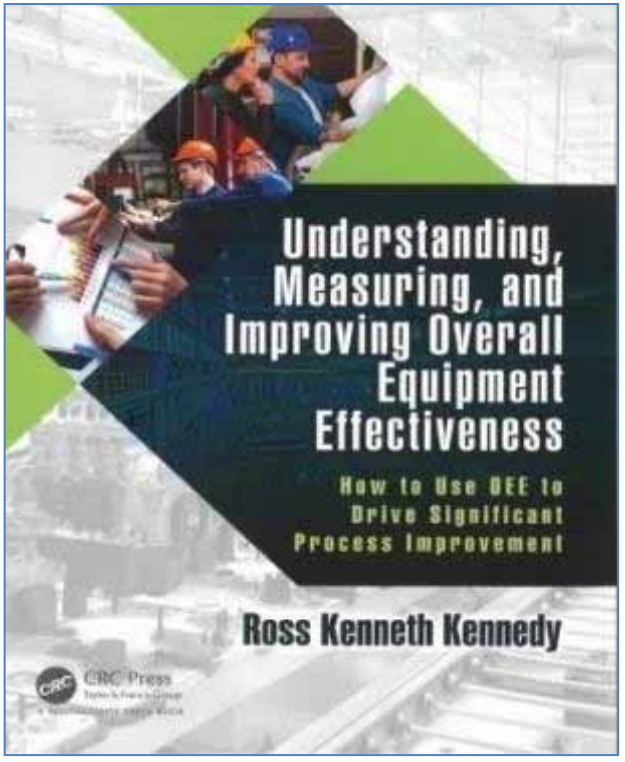
Understanding ALL the OEE Losses
on a Production Line

1. Establishing an OEE Model that covers the 7 Big Losses;
2. Recognising the 5 Issues that impact OEE Losses;
3. Role of the High Level OEE Equation for accurate measurement;
4. Limitations of focusing on the Top 3 Losses versus the tail of your Pareto Chart; and
5. Identifying and separating the Technical versus People Development losses.

Understanding, Measuring, and Improving Overall Equipment Effectiveness

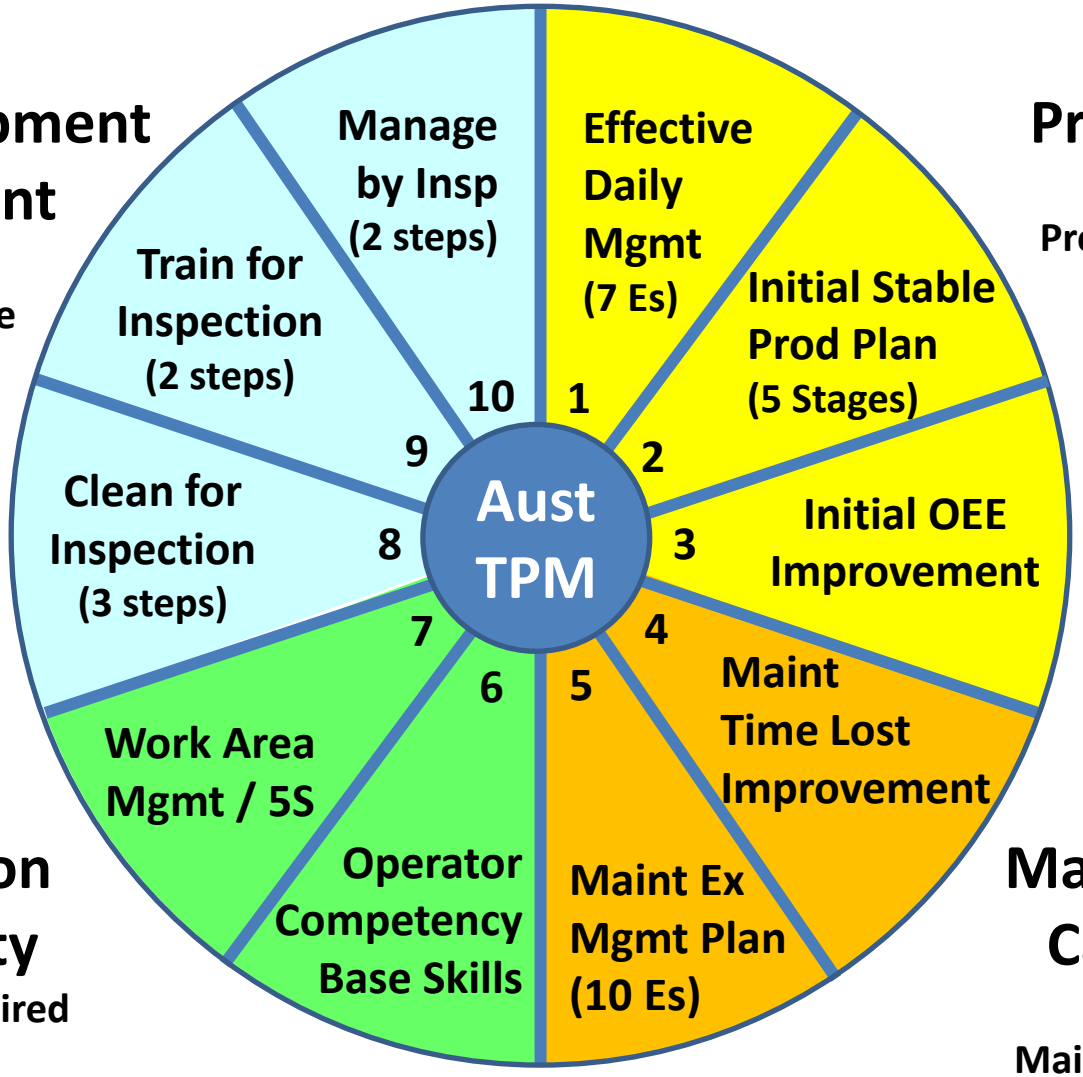
How to use OEE to drive Significant Process Improvement



1. Understanding OEE
2. Measuring OEE
3. Calculating OEE
4. Improving OEE
5. Using the OEE Loss Analysis Spreadsheet
6. Automating OEE Data Capture

Appx: OEE Improvement Rating

CTPM's 10 Integrated Ingredients of Australasian TPM



Preparation
to free up Production Time

Maintenance Capability
to free up Maintenance Time

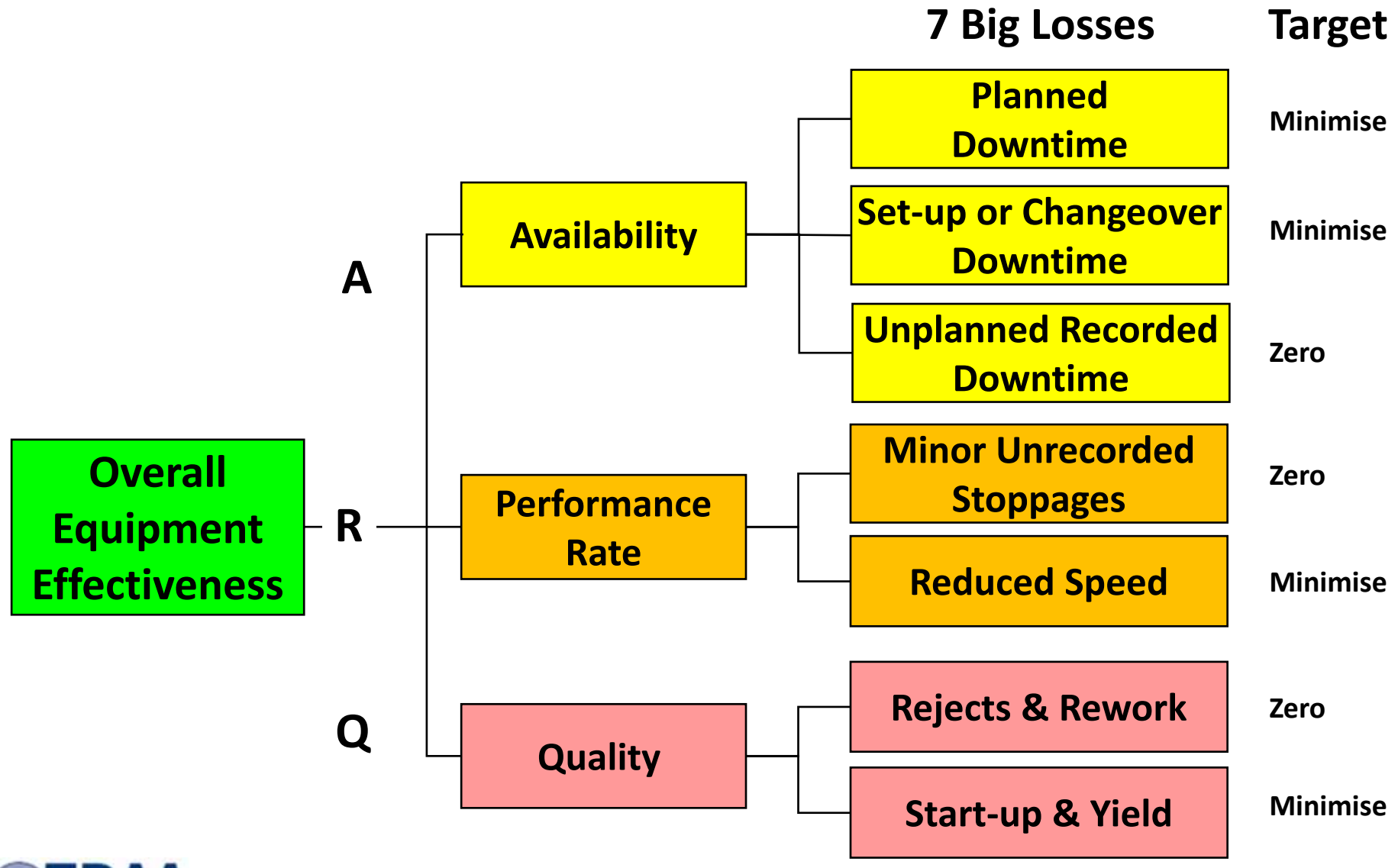
Production Capability
to ensure required discipline

Operator Equipment Management
to achieve TPM Excellence

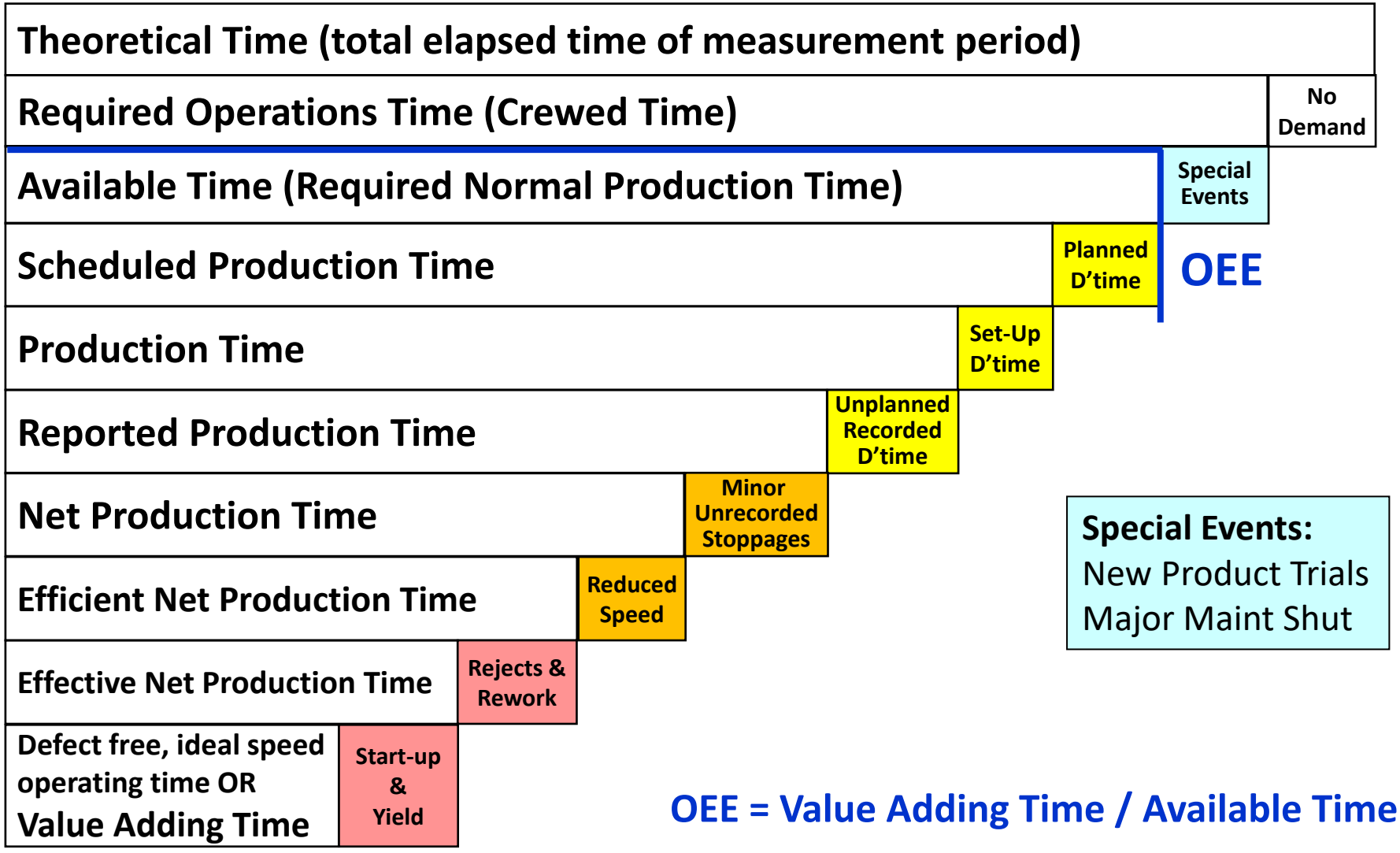
Why is OEE Improvement important for TPM & Operational Excellence?

- Increase capacity – every increase in % OEE should result in equal % increase in good output
- Defer the need to introduce overtime or extra shift if demand increases
- Free up time for Production Area Based Team improvement activities of Work Area Management (enhanced 5S) and Operator Equipment Management (Autonomous Maintenance) where Production Line may need to stop especially while doing Clean for Inspections

1. Establishing an OEE Model that covers the 7 Big Losses



Creating an Equipment Losses Model
to support typical Manufacturing Situation



Special Events:
New Product Trials
Major Maint Shut

OEE = Value Adding Time / Available Time

2. Recognising the 5 issues that impact OEE Losses

1. **Technical Issues**
   eg Unplanned Recorded Downtime
2. **People Development Issues**
   eg Reduced Speed
3. **Supplier Issues**
   eg Rejects & Rework
4. **Planning Issues**
   eg Set-up Downtime
5. **Management Issues**
   eg Planned Downtime

However all 7 Losses can be affected by the 5 issues above

3. Role of the High Level OEE Equation for accurate measurement;

The 3 Ways of Capturing OEE Loss Analysis Data

Continuous Recording

The accuracy of data can be quite low, especially the reason for the loss, when a lot of losses are occurring ie when OEE is below 60%.

Sampling through Observations

This will not give a true representation of all the losses due to the duration and frequency of the sample, however it should identify the Minor Unrecorded Stoppages and the Unplanned Interventions.

High Level Measurement

Good Output / (Available Time x Ideal Speed)

This is the most accurate measure of OEE however it does not highlight where the losses are coming from, ***but it does highlight how much Loss you must identify*.**

3. Role of the High Level OEE Equation for accurate measurement;

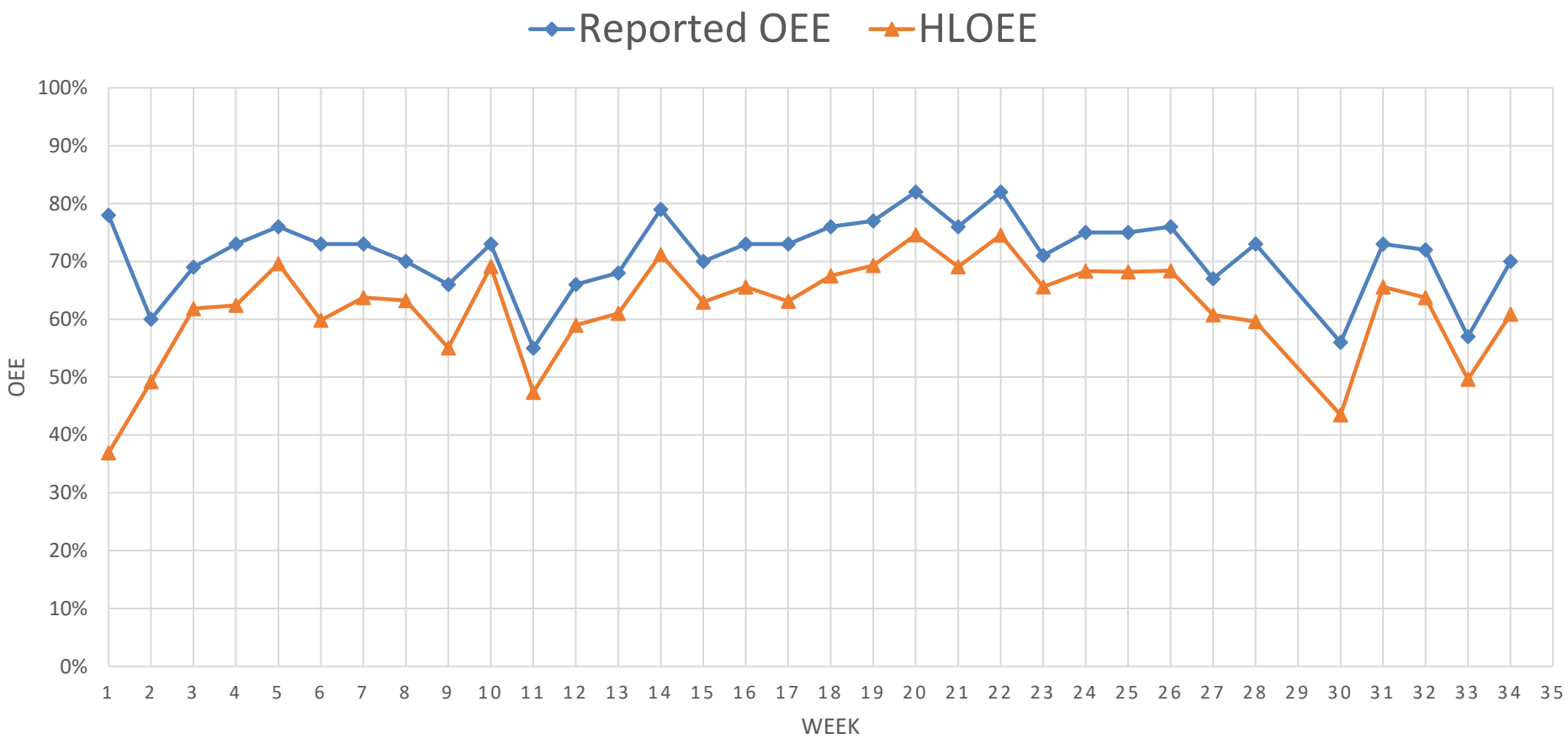
High Level Measurement

$$\textbf{HL OEE} = \frac{\textbf{Good Output Produced}}{\textbf{Available Time x Ideal Speed}} \textbf{ x 100 = \%}$$

Available Time is Production crew time (normal rostered time plus any overtime by the entire crew for production)

Ideal Speed is the sampled speed ***measured over a short period of time (eg 5 or 10 minutes),*** achievable with best Operator, best feed, best environmental conditions and best equipment conditions without “red lining” the equipment

OEE ANALYSIS



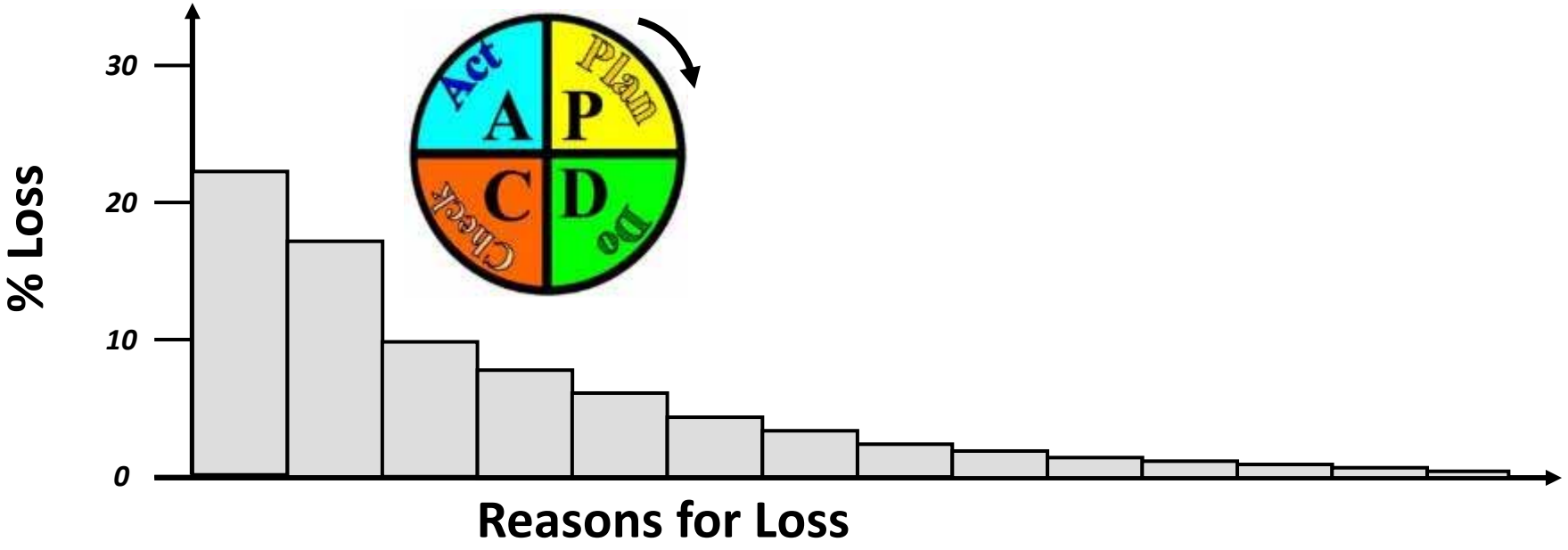
	Reported	High Level
Average:	71%	62%
Difference:		9 Percentage Points
% Difference: (71-62)/71 =		13%

4. Limitations of focusing on the Top 3 Losses vs Tail of your Pareto

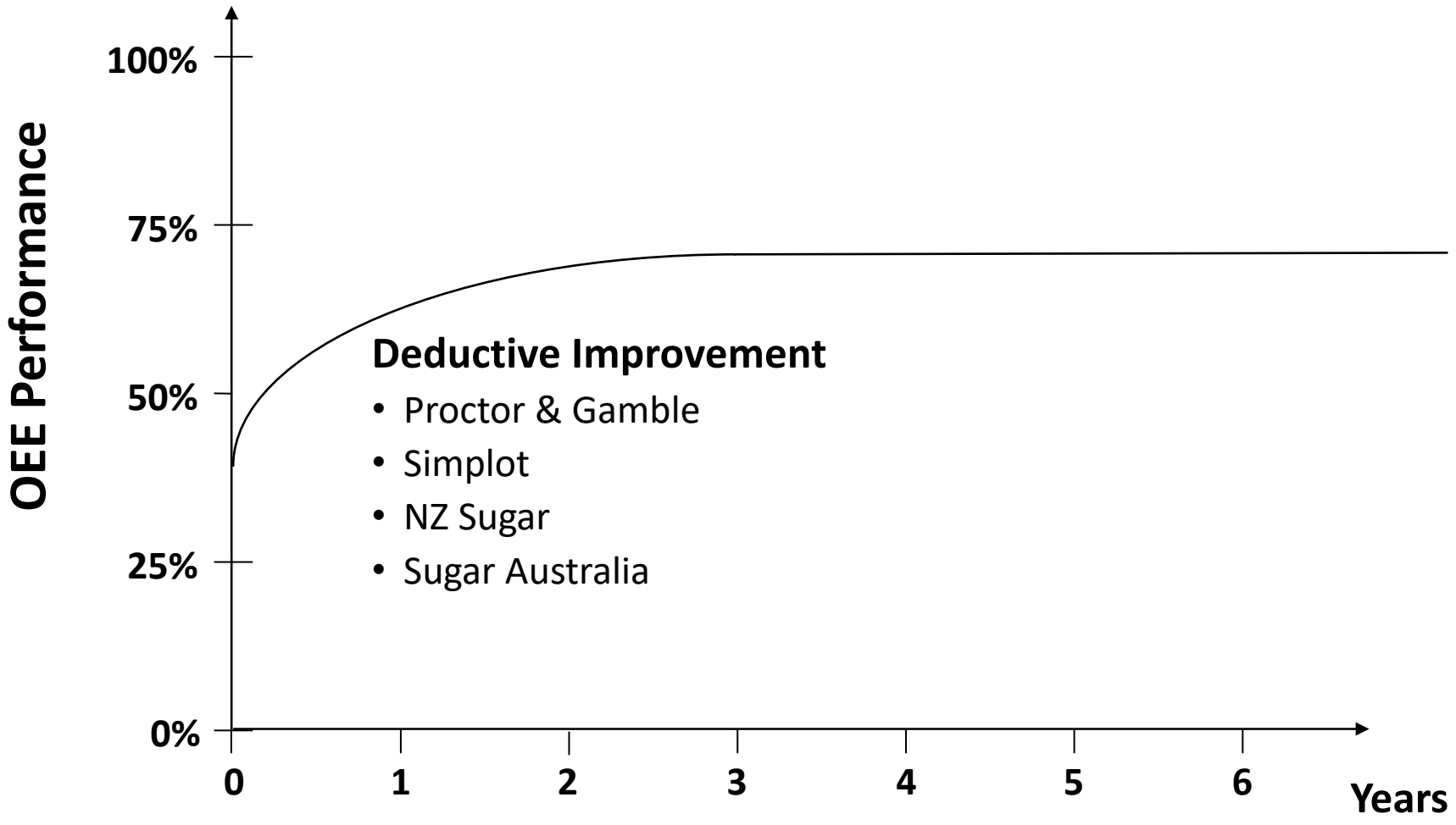
Different Approaches to OEE Improvement

Deductive using OEE Data Capture Systems and / or Cross-functional Teams to Identify the big losses and try to find the best solution

Technical Issues focus



Key Learning



Different Approaches to OEE Improvement

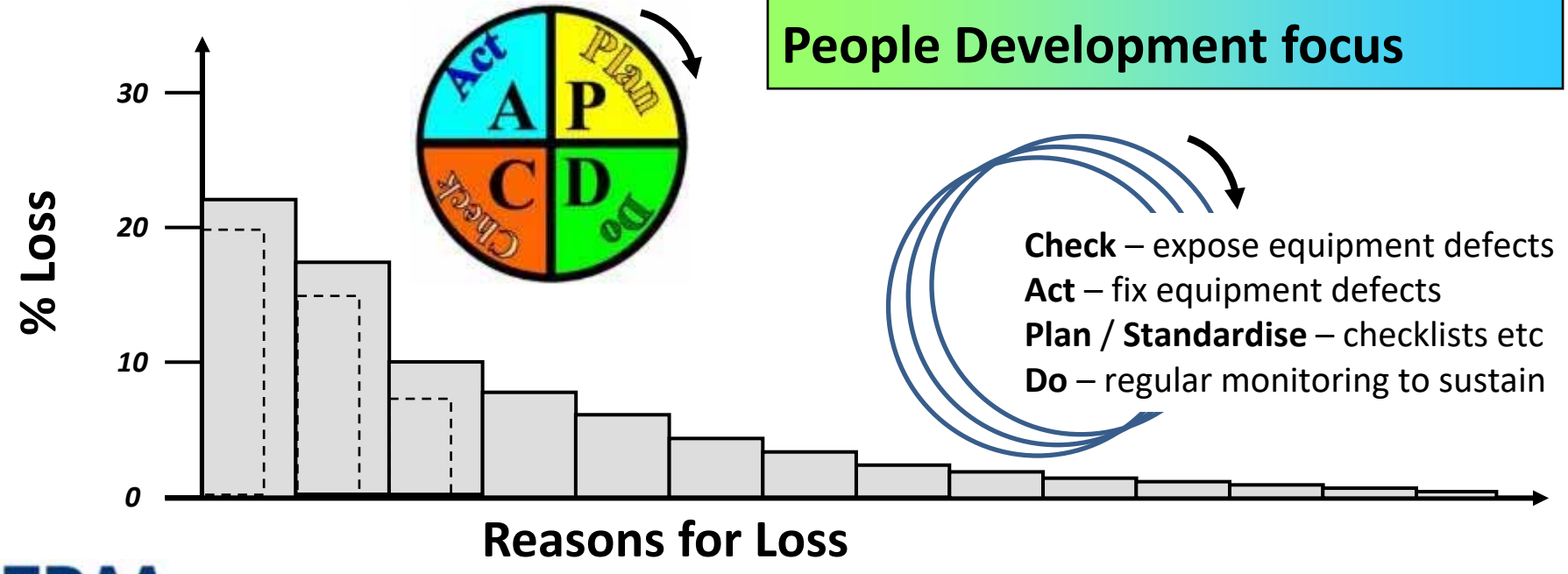
Need to Address losses from both ends of the Pareto Chart

Deductive using OEE Data Capture Systems and / or Cross-functional Teams to Identify the big losses and try to find the best solution

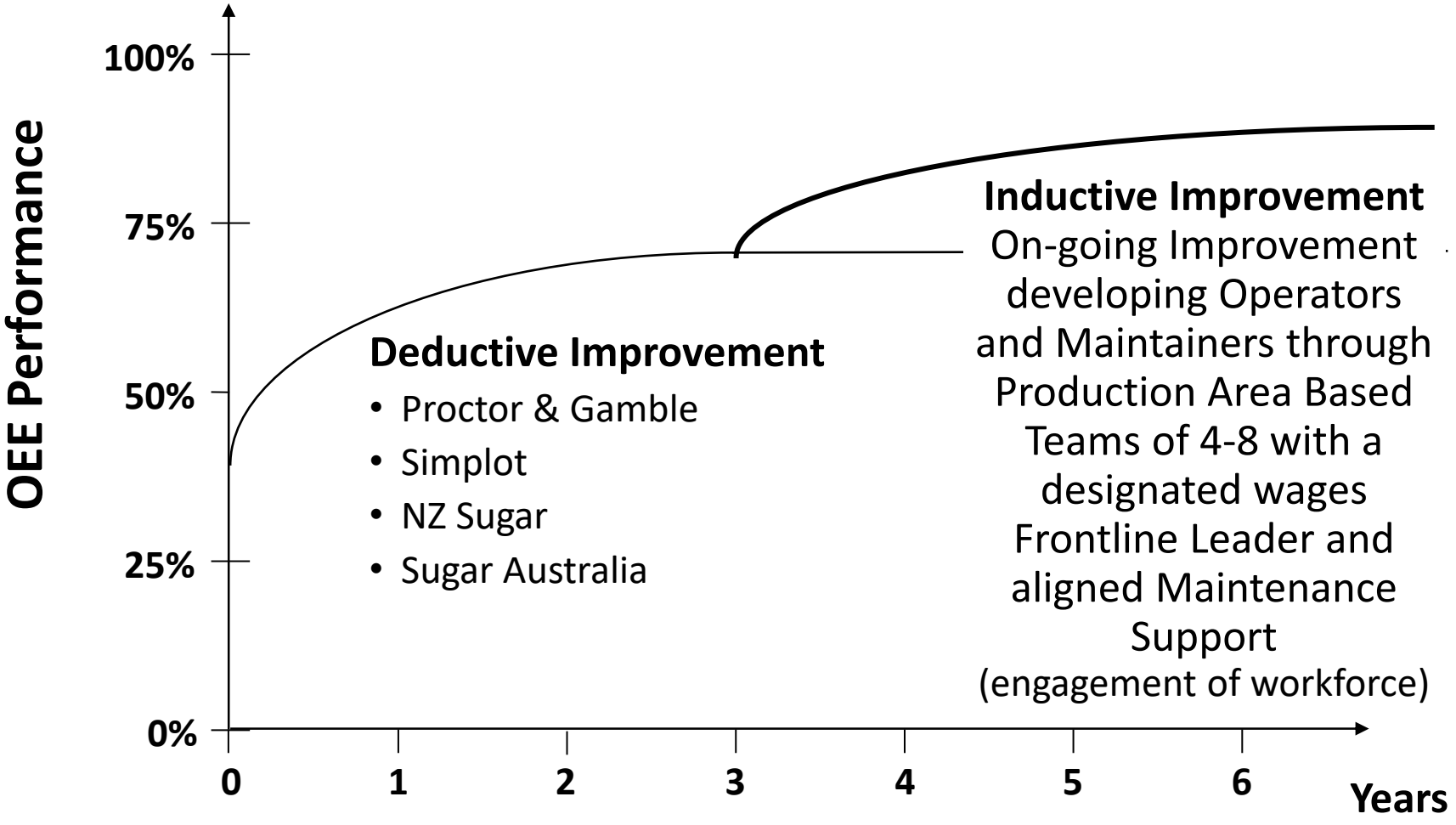
Technical Issues focus

Inductive using Production Area Based Teams to Focus on 'Prevention at Source' (everything that is not right such as equipment defects), recognising that the big losses will also reduce and become easier to solve

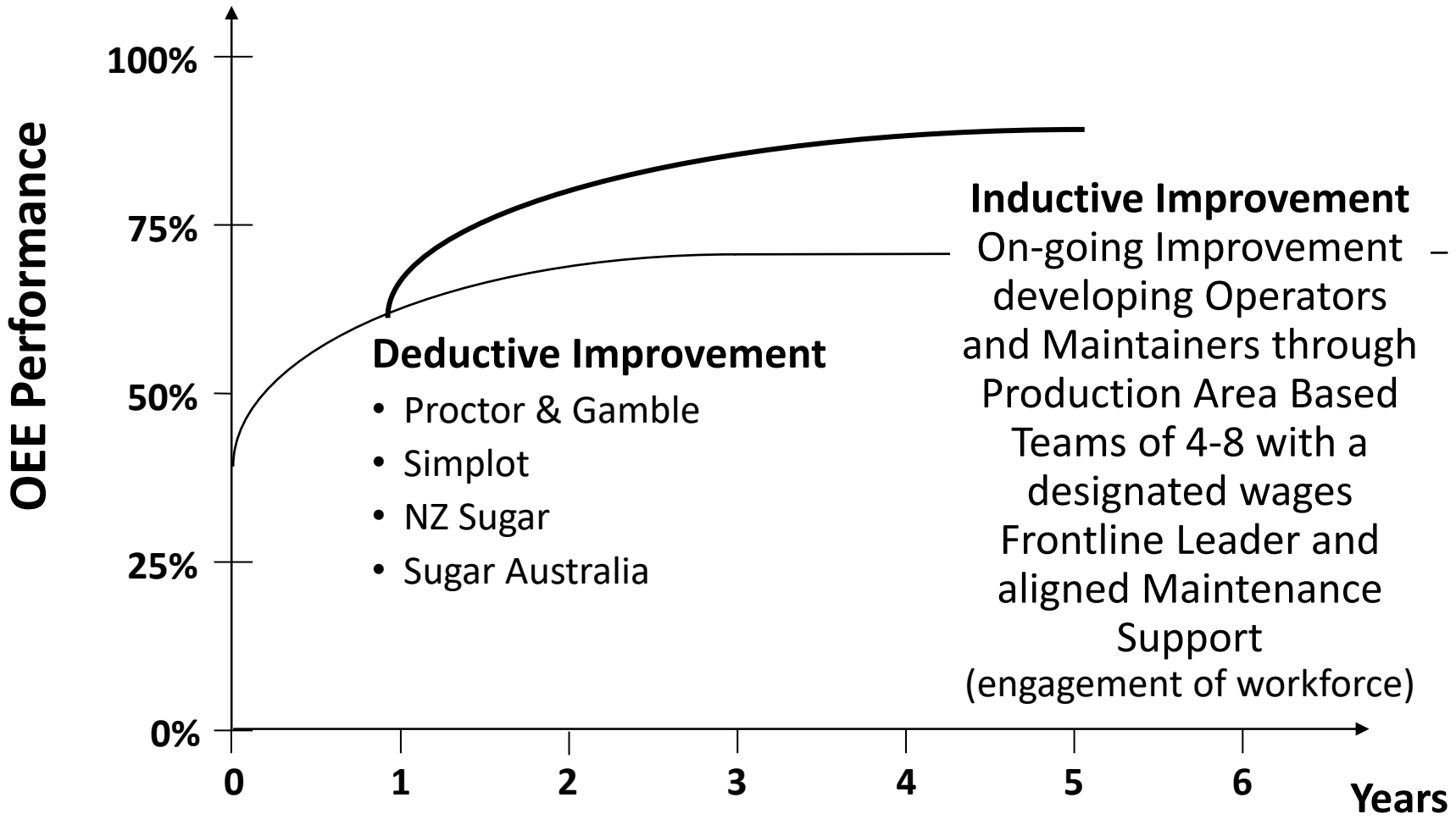
People Development focus



Key Learning



Key Learning



5. Identifying and separating the Technical versus People Development losses

Using the OEE Loss Analysis Spreadsheet

A very powerful tool to assist in more fully understanding not only where all the equipment losses are originating from, but most importantly the impact they will have when correctly addressed.

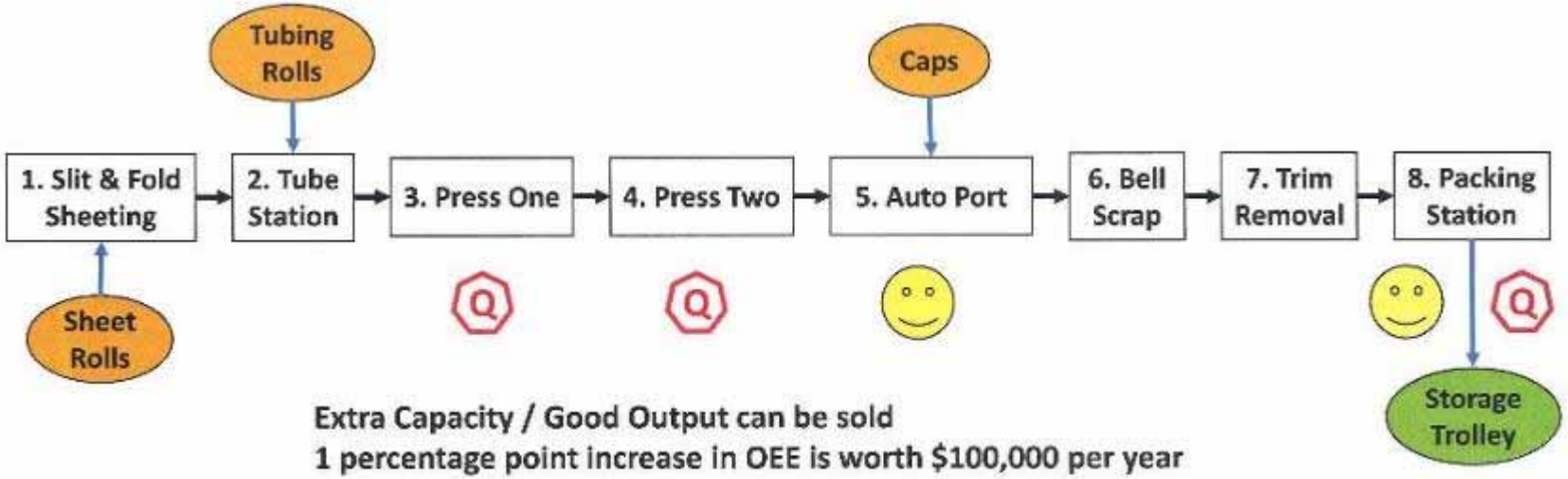
The spreadsheet consists of 7 interlinked sheets and uses a production line example to demonstrate how it should be used.

Example Production Line used in OEE Analysis Spreadsheet

Taken from High Level Process Flow Map Analysis

2 Operators per shift (10 total)
8 hour fixed shifts x 3 for 5 days
12 hours fixed shifts x 2 for 2 days (weekends)

#	Products	Ideal Speed
1	A	75 units / min
2	B	75 units / min
3	C	75 units / min



Extra Capacity / Good Output can be sold
1 percentage point increase in OEE is worth $100,000 per year

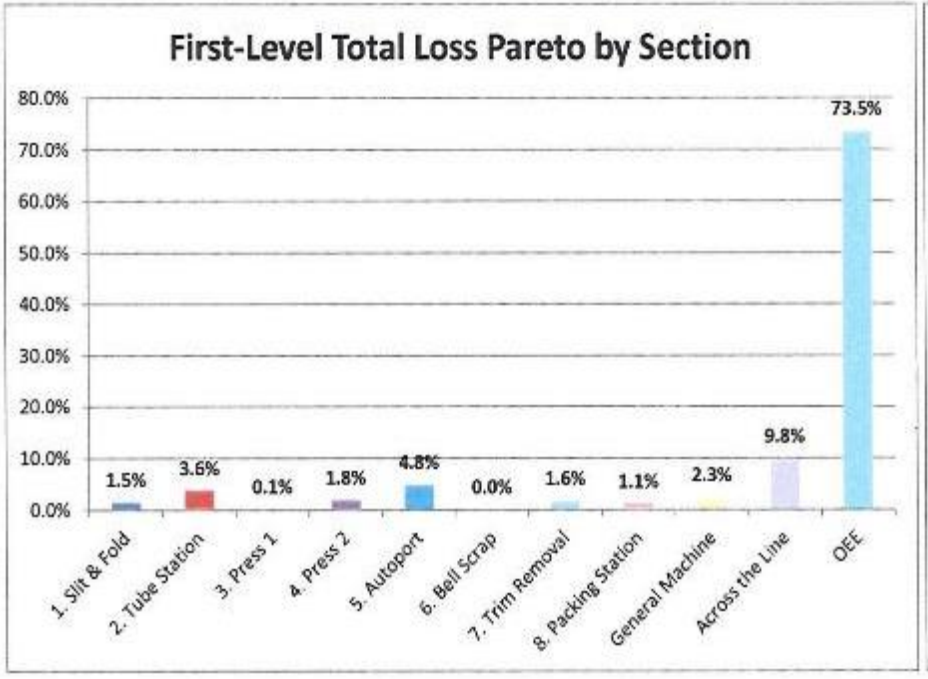
Second-Level OEE Loss Analysis			Baseline Analysis Previous 6 wks	As-Is' OEE Loss Analysis (Typically Weeks 2-4 of the Cycle)							
				Prod Reports (wk 24)	Prod Reports (wk 25)	Prod Reports (wk 26)	Ob 1 (Fri) (11.00-3.00) (wk 24) 12/6/20	Ob 2 (Tues) (11.00-4.00) (wk 25) 16/6/20	Ob 3 (Mon) (10.00-2.50) (wk 26) 22/6/20	"As-Is' OEE	"As-Is' OEE
Loss Description			% Loss	% Loss	% Loss	% Loss	% Loss	% Loss	% Loss	% Loss	% Loss
A	Planned Downtime	Planned Maintenance (12 hours 4 weekly)	1.8%	1.8%	1.8%	1.8%				1.8%	
		Start of Shift Meeting	0.0%	0.0%	0.0%	0.0%				0.0%	
		Start of Day Clean (20 mins)	1.4%	1.4%	1.4%	1.4%				1.4%	
		Planned Start of A/S & N/S Shift Clean (10 min)	1.4%	1.4%	1.4%	1.4%				1.4%	
		Planned End of Shift Downtime	0.0%							0.0%	
		WAM / OEM Activity Time	0.0%							0.0%	
		Communication Downtime (weekly 30 min per shift)	1.5%	1.5%	1.5%	1.5%				1.5%	
		n/a								0.0%	6.1%
	Set-up / Changeover	Size Change (every 3 weeks) 25 min extension of Clean	0.5%	0.3%						0.1%	
										0.0%	0.1%
	Unplanned Recorded Downtime	1. Slit & Fold								0.0%	
		2. Tube Station	1.1%	1.8%	2.1%	2.4%				2.1%	
		3. Press 1	0.2%		0.3%					0.1%	
		4. Press 2	0.8%	1.1%	1.6%	1.4%	4.2%			1.4%	
		5. Autoport	1.1%	2.1%	1.5%	2.4%				2.0%	
		6. Bell Scrap								0.0%	
		7. Trim Removal	0.4%	0.5%	0.6%	0.4%				0.5%	
		8. Packing Station	0.2%	0.3%	0.3%	0.2%				0.3%	
		General Machine	0.9%	1.5%	1.3%	1.9%				1.6%	7.9%
R	Minor Unrecorded Stoppages	1. Slit & Fold		19.3%	12.2%	10.3%	0.4%	3.7%	0.3%	1.5%	
		2. Tube Station					1.5%	2.3%	0.7%	1.5%	
		3. Press 1								0.0%	
		4. Press 2					0.6%	0.3%	0.5%	0.5%	
		5. Autoport					0.1%	7.9%	0.3%	2.8%	
		6. Bell Scrap								0.0%	
		7. Trim Removal					1.3%	1.5%	0.6%	1.1%	
		8. Packing Station					0.7%	0.4%	0.5%	0.5%	
		General Machine						1.0%		0.3%	8.2%
	Reduced Speed	Slow Running					3.4%	3.8%	3.5%	3.6%	
		Time to achieve Good Output at Correct Speed after start-up (eg from a set-up or breakdown)								0.0%	3.6%
Q	Rejects & Rework	1. Slit & Fold								0.0%	
		2. Tube Station								0.0%	
		3. Press 1								0.0%	
		4. Press 2								0.0%	
		5. Autoport								0.0%	
		6. Bell Scrap								0.0%	
		7. Trim Removal								0.0%	
		8. Packing Station					0.7%	0.4%	0.5%	0.3%	
		General Machine					0.8%	0.7%	0.9%	0.4%	0.7%
	Start-Up & Yield Loss	Start-up Product Loss till Good Output		Unknown	Unknown	Unknown				0.0%	
		Yield Loss while running		Unknown	Unknown	Unknown				0.0%	0.0%
		Error in Data Collection	15.5%	n/a	n/a	n/a	20.9%	21.4%	13.0%	n/a	
		Total Losses (Potential for Improvement)	26.8%	33.0%	26.0%	25.0%	34.6%	43.4%	20.8%	26.5%	26.5%
		HLOEE	73.2%	67.0%	74.0%	75.0%	65.4%	56.6%	79.2%	73.5%	
		Production Reports Average HLOEE			72.0%						

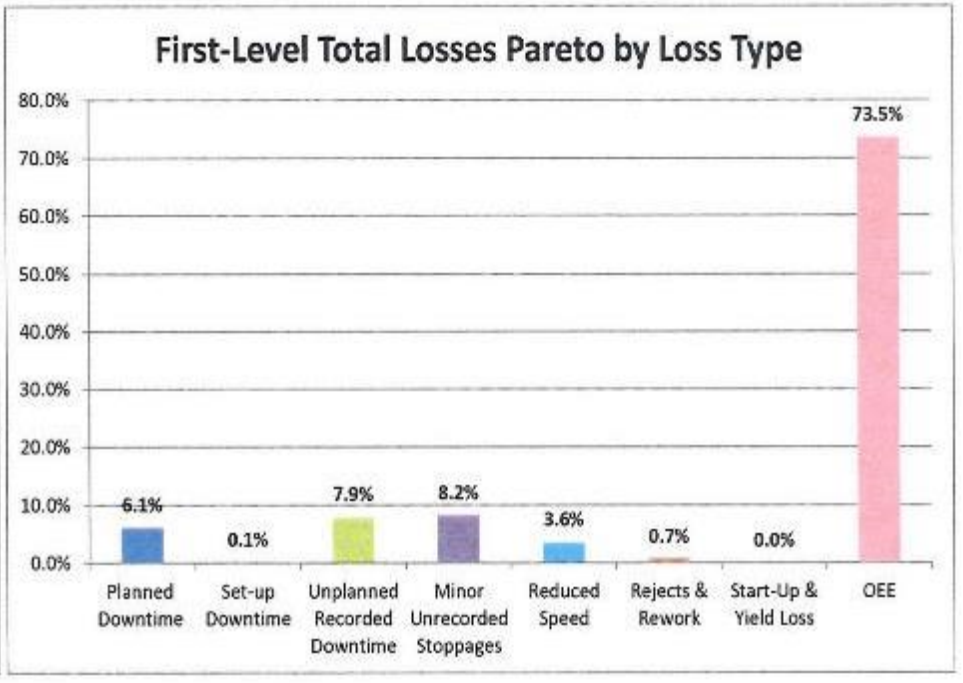
The 'As-Is' OEE is typically calculated using the figures in Yellow

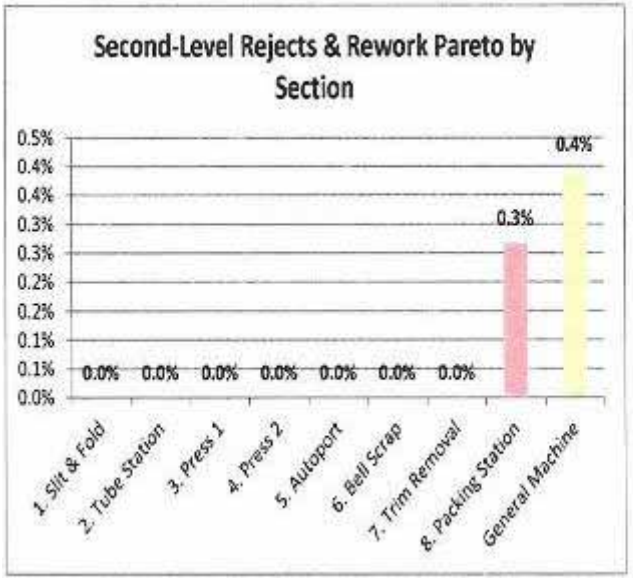
Second-Level OEE Loss Analysis Sheet

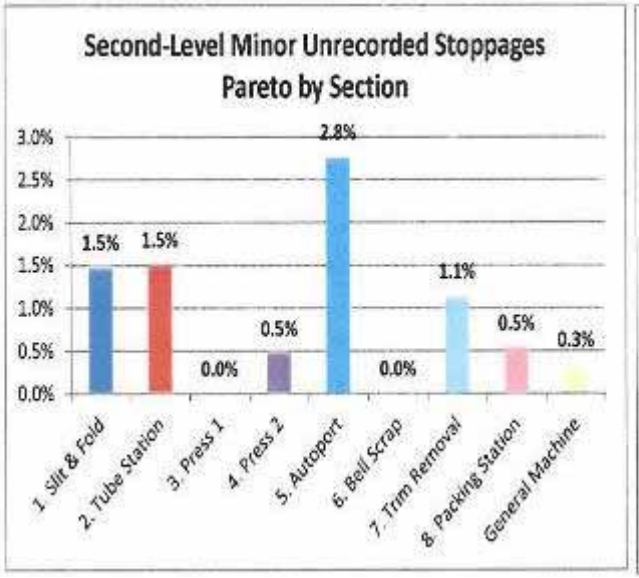
		A			R		Q			
Section	Manning	Planned Downtime	Set-up Downtime	Unplanned Recorded Downtime	Minor Unrecorded Stoppages	Reduced Speed	Rejects & Rework	Start-up & Yield	Total Loss	People Allocation
1. Slit & Fold	1			0.0%	1.5%		0.0%		1.5%	11.7%
2. Tube Station				2.1%	1.5%		0.0%		3.6%	
3. Press 1				0.1%	0.0%		0.0%		0.1%	
4. Press 2				1.4%	0.5%		0.0%		1.8%	
5. Autoport				2.0%	2.8%		0.0%		4.8%	
6. Bell Scrap				0.0%	0.0%		0.0%		0.0%	
7. Trim Removal	1			0.5%	1.1%		0.0%		1.6%	2.7%
8. Packing Station				0.3%	0.5%		0.3%		1.1%	
General Machine				1.6%	0.3%		0.4%		2.3%	
Across the Line		6.1%	0.1%			3.6%		0.0%	9.8%	9.8%
Totals	**2**	**6.1%**	**0.1%**	**7.9%**	**8.2%**	**3.6%**	**0.7%**	**0.0%**	**26.5%**	
OEE									73.5%	

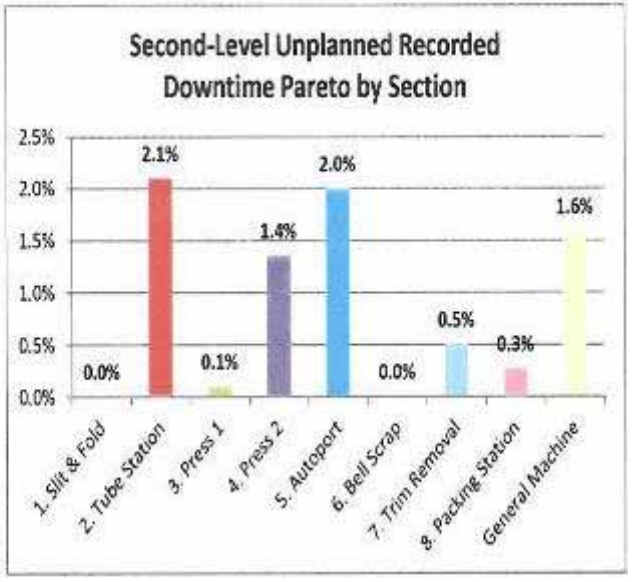
Why?











Second Level OEE Improvement Vision Sheet

	Loss Description		"As-Is" OEE % Loss	12 Mth Vision within 3 Cycles	Ideal Vision within 3 Years	Reasons / Assumptions for Ideal Vision within 3 Years / 10 Cycles after successfully completing WAM / 5S and the 7 Steps of Operator Equipment Management / Autonomous Maintenance	"As-Is" OEE % Loss	12 Mth Vision within 3 Cycles	Ideal Vision within 3 Years
A	Planned Downtime	Planned Maintenance (12 hours 4 weekly)	1.8%	0.2%	0.1%	4 hours every 6 months, rest done during WAM / OEM time			
		Start of Shift Meeting	0.0%	2.0%	2.0%	10 minute start of shift meeting			
		Start of Day Clean (20 mins)	1.4%	1.4%	1.4%	20 min Start of Day Clean (1.4%)			
		Planned Start of A/S & N/S Shift Clean (10 min)	1.4%	1.4%	1.4%	10 min Start of A/S & N/S Clean (1.4%)			
		Planned End of Shift Downtime	0.0%	0.0%	0.0%				
		WAM / OEM Activity Time	0.0%	3.6%	3.6%	1.5 hours per week per 4 shift (3.6%)			
		Communication Downtime (weekly 30 min per shift)	1.5%	0.3%	0.3%	Move to monthly after introducing Start of Shift Meetings			
		n/a	0.0%				6.1%	8.9%	8.8%
	Set-up Downtime	Size Change (every 3 weeks) 25 min extension of Clean	0.1%		0.1%	Conducted at start of shift so only 25 min impact every 3 wks			
		0	0.0%				0.1%	0.0%	0.1%
	Unplanned Recorded Downtime	1. Slit & Fold	0.0%	0.0%	3.0%	Goal is Zero Breakdowns however will allow 3.0% or approx 15 mins per 8 hour shift recognising there is 20 mins of planned downtime at start of each day			
		2. Tube Station	2.1%	1.9%					
		3. Press 1	0.1%	0.1%					
		4. Press 2	1.4%	1.2%					
		5. Autoport	2.8%	1.8%					
		6. Bell Scrap	0.0%	0.0%					
		7. Trim Removal	0.5%	0.4%					
		8. Packing Station	0.3%	0.2%					
		General Machine	1.6%	1.4%					
R	Minor Unrecorded Stoppages	1. Slit & Fold	1.5%	0.9%	0.2%	Change Roll every 40 minutes for 5 seconds (65 sec / shift or 0.2% OEE loss)			
		2. Tube Station	1.5%	1.1%	0.7%	Tube change every 7 hours for 3 minutes (3.38 min / shift or 0.7% OEE Loss)			
		3. Press 1	0.0%	0.0%	0.0%				
		4. Press 2	0.5%	0.0%	0.0%				
		5. Autoport	2.8%	1.4%	0.0%	Ideally should be zero			
		6. Bell Scrap	0.0%	0.0%	0.0%				
		7. Trim Removal	1.1%	0.7%	0.2%	Trim removal every 40 minutes for 5 seconds (in addition to 1.) (65 sec / shift or 0.2% OEE loss)			
		8. Packing Station	0.5%	0.1%	0.0%	Ideally should be zero			
		General Machine	0.3%	0.0%	0.0%		8.2%	4.1%	1.1%
	Reduced Speed	Slow Running	3.6%	1.8%	0.0%	50% improvement in first 12 months			
		Time to achieve Good Output at Correct Speed after start-up (eg from a set-up or breakdown)	0.0%		0.0%	Instanteous full speed start up	3.6%	1.8%	0.0%
Q	Rejects & Rework	1. Slit & Fold	0.0%		0.2%	Goal is zero however will allow 0.2% for any losses caused by Unplanned Recorded Downtime or Changeovers			
		2. Tube Station	0.0%						
		3. Press 1	0.0%						
		4. Press 2	0.0%						
		5. Autoport	0.0%						
		6. Bell Scrap	0.0%						
		7. Trim Removal	0.0%						
		8. Packing Station	0.3%						
		General Machine	0.4%	0.2%			0.7%	0.2%	0.2%
	Start-Up & Yield Loss	Start-up Product Loss till Good Output	0.0%						
		Yield Loss while running	0.0%				0.0%	0.0%	0.0%
		Total Losses (Potential for Improvement)	**26.5%**	**22.0%**	**13.2%**		**26.5%**	**22.0%**	**13.2%**
		OEE	**73.5%**	**78.0%**	**86.8%**				

The "12 Mth Vision" OEE is typically calculated based on 50% of gap between "As-Is" and "Ideal Vision" with any adjustments where delays to improvement are expected

Second Level OEE Improvement Vision Sheet

		'As-Is' OEE % Loss	12 month Vision Within 3 Cycles	Ideal Vision Within 3 Years	Reasons / Assumptions for Ideal Vision	'As-Is' OEE % Loss	12 month Vision Within 3 Cycles	Ideal Vision Within 3 Years
Minor Unrecorded Stoppages	1. Slit & Fold	1.5%	0.9%	0.2%	Change Roll every 40 minutes for 5 seconds (65 sec / shift or 0.2% OEE loss)			
	2. Tube Station	1.5%	1.1%	0.7%	Tube change every 7 hours for 3 minutes (3.38 min / shift or 0.7% OEE Loss)			
	3. Press 1	0.0%	0.0%	0.0%				
	4. Press 2	0.5%	0.0%	0.0%				
	5. Autoport	2.8%	1.4%	0.0%	Ideally should be zero			
	6. Bell Scrap	0.0%	0.0%	0.0%				
	7. Trim Removal	1.1%	0.7%	0.2%	Trim removal every 40 minutes for 5 seconds (in addition to 1.) (65 sec / shift or 0.2% OEE loss)			
	8. Packing Station	0.5%	0.1%	0.0%	Ideally should be zero			
	General Machine	0.3%	0.0%	0.0%		8.2%	4.1%	1.1%

Second Level OEE Improvement Gap High Level Opportunity Analysis Sheet

Loss Description			"As-Is" OEE % Loss	Ideal Vision within 3 Yrs % Loss	Gap Analysis % Loss	High Level Opportunities Analysis			Gap Analysis % Loss	High Level Opportunity	
						Cross-functional Teams (Technical)	Area Based Teams (People Development)	% PD Allocated		XFT	ABT
A	Planned Downtime	Planned Maintenance (12 hours 4 weekly)	1.8%	0.1%	1.7%	0.43%	1.28%	75%			
		Start of Shift Meeting	0.0%	2.0%	-2.0%	-1.00%	-1.00%	50%			
		Start of Day Clean (20 mins)	1.4%	1.4%	0.0%	0.00%	0.00%	50%			
		Planned Start of A/S & N/S Shift Clean (10 min)	1.4%	1.4%	0.0%	0.00%	0.00%	50%			
		Planned End of Shift Downtime	0.0%	0.0%	0.0%	0.00%	0.00%	50%			
		WAM / OEM Activity Time	0.0%	3.6%	-3.6%	0.00%	-3.60%	100%			
		Communication Downtime (weekly 30 min per shift)	1.5%	0.3%	1.2%	0.60%	0.60%	50%			
		n/a	0.0%	0.0%	0.0%				-2.7%	0.0%	-2.7%
	Set-up Downtime	Size Change (every 3 weeks) 25 min extension of Clean	0.1%	0.1%	0.0%	0.00%	0.00%	100%			
		0	0.0%	0.0%	0.0%	0.00%	0.00%	100%	0.0%	0.0%	0.0%
	Unplanned Recorded Downtime	1. Slit & Fold	0.0%	3.0%	0.0%	0.00%	0.00%	50%			
		2. Tube Station	2.1%		1.1%	0.27%	0.80%	75%			
		3. Press 1	0.1%		0.1%	0.03%	0.03%	50%			
		4. Press 2	1.4%		0.7%	0.34%	0.34%	50%			
		5. Autoport	2.0%		1.0%	0.51%	0.51%	50%			
		6. Bell Scrap	0.0%		0.0%	0.00%	0.00%	50%			
		7. Trim Removal	0.5%		0.3%	0.13%	0.13%	50%			
		8. Packing Station	0.3%		0.1%	0.03%	0.10%	75%			
		General Machine	1.6%		0.8%	0.40%	0.40%	50%	4.0%	1.7%	2.3%
R	Minor Unrecorded Stoppages	1. Slit & Fold	1.5%	0.2%	1.3%	0.32%	0.95%	75%			
		2. Tube Station	1.5%	0.7%	0.8%	0.20%	0.60%	75%			
		3. Press 1	0.0%	0.0%	0.0%	0.00%	0.00%	75%			
		4. Press 2	0.5%	0.0%	0.5%	0.12%	0.35%	75%			
		5. Autoport	2.8%	0.0%	2.8%	0.69%	2.08%	75%			
		6. Bell Scrap	0.0%	0.0%	0.0%	0.00%	0.00%	75%			
		7. Trim Removal	1.1%	0.2%	0.9%	0.23%	0.70%	75%			
		8. Packing Station	0.5%	0.0%	0.5%	0.13%	0.40%	75%			
		General Machine	0.3%	0.0%	0.3%	0.08%	0.25%	75%	7.1%	1.8%	5.3%
	Reduced Speed	Slow Running	3.6%	0.0%	3.6%	0.00%	3.57%	100%			
		Time to achieve Good Output at Correct Speed after start-up (eg from a set-up or breakdown)	0.0%	0.0%	0.0%	0.00%	0.00%	100%	3.6%	0.0%	3.6%
Q	Rejects & Rework	1. Slit & Fold	0.0%	0.2%	0.0%			50%			
		2. Tube Station	0.0%		0.0%			50%			
		3. Press 1	0.0%		0.0%			50%			
		4. Press 2	0.0%		0.0%			50%			
		5. Autoport	0.0%		0.0%			50%			
		6. Bell Scrap	0.0%		0.0%			50%			
		7. Trim Removal	0.0%		0.0%			50%			
		8. Packing Station	0.3%		0.0%			50%			
		General Machine	0.4%		0.0%			50%	0.0%	0.0%	0.0%
	Start-Up & Yield Loss	Start-up Product Loss till Good Output	0.0%	0.0%	0.0%			50%			
		Yield Loss while running	0.0%	0.0%	0.0%			50%	0.0%	0.0%	0.0%
Total Losses (Potential for Improvement)			26.5%	13.2%	12.0%	3.5%	8.5%		12.0%	3.5%	8.5%
OEE			73.5%	86.8%							

Note: This document should be available for review and approval by the Leadership Team before the Pre-cycle Strategy Planning Session and team Final Presentation

Getting Started using a Cross-functional Team

Ideally the team should have 7-8 members

- Production Supervisor for Area (Level 1 Salary) – Lead the Team
- Production Frontline Leader / Leading Hand for Area (wages)
- Operator
- Mech Maintainer responsible for area
- Elect Maintainer responsible for area
- 2 x Tech Support responsible for area eg Engineering; Quality; HR / Training; Procurement; Prod Planner
- Leadership Team Member eg Prod; Maint; Tech Mgr

Summary - Key Learning

- There are 5 key issues affecting OEE performance and as such an holistic approach is needed to fully understand all issues affecting the 7 losses
- OEE is an Improvement Drive, not a performance measure for comparing
- There are 3 methods of OEE measurement: Continuous Recording, Sampling through Observations and High Level Measurement - the most effective approach is to use all three methods in concert
- Conducting an analysis to support OEE improvement is best done with a properly structured Cross-functional Team committing about 5% of their normal work time over 12-14 weeks

How can we help?

Range of Support Materials

Macro Focused Equipment & Process Improvement

Cross-functional Team Member Manual

Support Programs

CTPM Site Membership Program

TPM & Operational Excellence Community of Australasia

Funding through the NSW Smart and Skilled Program

Available for NSW Clients Only

Questions or Comments

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Submitted Questions or Comments

1. **Peter, WA:** What specific data is required? Are there any system limitations (only for certain CMS or does the data work across all recognised systems)
2. **Lalit, India:** Detailed analysis required regarding OEE losses
3. **Balakumar, India:** Whether the losses by downtime can be eliminated