



## Audience Profile

The manual is suitable for everybody seeking to improve return on asset investment with Asset Output Optimization (formerly Total Productive Maintenance). The manual systematically guides you through the application of Asset Output Optimization in the elimination of losses and waste, the measurement and calculation of the Overall Asset Effectiveness factor and the introduction of operator-maintenance. In particular, Asset Owners, Managers, Engineers, Planners, Trades people, Operators, Finance Managers, Safety Officers and all those who contribute in their roles of operators and maintainers, engineering, designers, logistics, admin, workshops, etc. to the output of asset in quantity and quality.

## Objectives

To equip those active in the management of productive and infrastructure assets with the knowledge, skills and attitudes to optimize the quality and quantity of asset outputs (revenue) and minimize risk and the use of inputs (costs).



The course further aims to provide an understanding of:

- the urgency of introducing AOO for realizing the full output potential of productive assets;
- the knowledge, understanding, skills and attitudes necessary to perform AOO analyses, introduce operator-maintainer principles and develop a dynamic asset maintenance plan in a systematic way, against the general background of asset management; and
- the power of the Overall Asset Effectiveness factor for single assets, processes analyses and decision making.

## What makes our approach different?

The main difference is taking Total Productive Maintenance out of the maintenance realm and placing it where it belongs, with the operators. We will accommodate former maintainers and operators in process-based first-line asset management teams. We provide detailed coverage of the calculation of the Overall Asset Effectiveness factor and the implication of this for 'hidden asset capacities', life cycle costs and profits. We also developed and include AOO analysis forms.

To assist in mastering the material in this manual, we include questions throughout the chapters and team exercises at the end of most chapters. The questions intend to link the material to implementation in the reader's organization. If you have limited experience with the material, it is important to wholeheartedly embrace these questions. The team exercises further intend to 'capture' important members of the readers' work teams in the hope of promoting a wider interest in what the techniques can do for the organisation.



## Contents

### 1. Total Productive Maintenance/Asset Output Optimization Explained

Historic development of Total Productive Maintenance  
Traditional manufacturing processes  
What are lean manufacturing and the Toyota Production System?  
How does the Toyota Production System link to Total Productive Maintenance?  
What are the effects of Just-In-Time manufacturing?  
How do you maintain productive output?  
What are the effects of reduced redundancy in utility networks?  
First generation TPM  
Second generation TPM  
Third generation TPM  
What is TPM and Asset Output Optimization?  
What are the objectives and goals of Asset Output Optimization?  
How does Asset Output Optimization link to asset management?  
Definitions and acronyms  
What are the benefits of applying Asset Output Optimization?  
Why should you consider using Asset Output Optimization?  
What is the Asset Output Optimization process?  
How should you implement Asset Output Optimization?

### 2. How to Identify Process or Asset Functions and Performance Standards?

Desired learning outcomes  
How to identify the process or assets for analysis?  
How important is an asset hierarchy?  
What are process and functional block diagrams?  
What is an asset register?  
Which asset register structure?  
How to collect data?  
Who should be responsible for data collection?  
Which asset to analyse first?  
Pareto analysis  
How to select significant functions?  
How do you assess criticality?  
How can you rank asset reliability costs?  
How do you comprehensively describe functions?  
What are process or asset functions?  
Can you link functions to the current asset application?  
Can you include asset policy in function description?  
Can you link functions to the operator tasks?  
What are the functional performance levels?  
Main outcomes of Chapter Two  
Syndicate Exercise 1

### 3 What Are Losses, Waste, Causes, Effects, Detection, Consequences and Criticalities?

Desired learning outcomes  
What are causes for asset performance deterioration?  
What are causes for reduced asset output?  
What are the six big losses?  
Asset down time (unplanned)  
Performance efficiency losses  
Process or output defects  
What are management-induced Losses?  
Which losses happen in support functions?  
What are authority-induced losses?

What is the difference between sporadic or chronic faults?  
What is waste?  
How do you detect losses or waste?  
How do you link losses, waste and root causes?  
What are the effects of losses and Waste?  
How to assess risk?  
What is the severity of a loss or waste?  
What is the likelihood of occurrence?  
AS/NZS 4360 Risk management  
How to calculate risk?  
Do you need to assess detectability?  
Main outcomes of Chapter Three  
Syndicate Exercise 2

### 4. What Is the Overall Asset Effectiveness Factor?

Desired learning outcomes  
What is Overall Asset Effectiveness?  
How to measure the Overall Asset Effectiveness?  
How to calculate Overall Asset Effectiveness?  
What data do you need to collect?  
What is the Availability Factor or Operating Rate?  
What is the Performance Efficiency Factor?  
What is the Quality Efficiency Factor?  
What is the Planning Factor?  
Example of calculating the OAE  
Second example of calculating the OAE  
How to calculate the Overall Asset Effectiveness for processes?  
How to perform a detailed production analysis?  
More definitions:  
Information gathering  
What are the basic calculation inputs?  
How to perform the OAE calculation with Nakajima Formulas?  
How to perform the OAE Calculation with event time?  
How to perform the OAE Calculation based on good units?  
Loss analysis and reconciliation  
How to interpret OAE/TAP calculations?  
What are the financial impacts of OAE improvement?  
What is the impact on income?  
What is the impact on return on assets?  
What are Overall Asset Effectiveness goals?  
What are the benefits of improving the OAE?  
How do you raise the Overall Asset Effectiveness?  
Main outcomes of Chapter Four  
Syndicate Exercise 3

### 5 How to Eliminate Losses and Waste?

Desired learning outcomes  
How to achieve zero breakdowns?  
How to eliminate chronic faults?  
How to restore assets to optimal conditions?  
How to achieve zero faults?  
How to minimize set-up and adjustment losses?  
How to reduce idling and minor stoppage losses?  
How to reduce performance or speed losses?  
How to reduce chronic quality losses?  
How to reduce start-up or re-start losses?  
How to eliminate authority-induced losses?  
How to eliminate waste?  
Main outcomes of Chapter Five



## 6. What Is the Asset Output Optimization Team Approach?

Desired learning outcomes  
How to develop optimum workplace conditions?  
Improve workplace environment  
Improve asset operability and maintainability  
The 5S housekeeping philosophy  
What is autonomous maintenance?  
Operator training  
Autonomous maintenance in support functions  
Extension of support function TPM to suppliers and distributors  
What is the maintainer program?  
Maintainer training  
Training of other personnel  
How to write standard task procedures?  
What is the team or small group approach?  
How to achieve an effective team?  
What are process-based teams?  
What are empowered employees?  
What are first-line asset managers?  
What are second-line asset managers?  
Who is the process team leader?  
Why share the benefits with the employees?  
What organisational structure should you adopt?  
Main outcomes of Chapter Six

## 7. How to Use the Asset Output Optimization Analysis Sheets?

Desired learning outcomes  
Our Asset Output Optimisation information sheet  
Function and performance level description  
Description, causes and effects of loss or waste  
Our Asset Output Optimisation decision sheet  
Detection of loss or waste

Risk assessment  
Task description and assessment of cost-effectiveness  
Task frequency  
Main outcomes of Chapter Seven  
Syndicate exercise 4

## 8. How to Implement Asset Output Optimization?

Desired learning outcomes  
How to organize for AOO implementation?  
Do not pass the AOO Analyses to consultants!  
What is the role of team members?  
What is the role of the facilitator?  
What are the steps of AOO implementation?  
Step 1 collect information about AOO  
Step 2 initial site audit and presentation to management  
Step 3 announce management's decision to introduce AOO  
Step 4 form and train teams  
Step 5 establish vision, mission and AOO policies, strategies and goals  
Step 6 formulate a master plan for AOO development  
Step 7 perform a feasibility study  
Step 8 start pilot implementations  
Step 9 plant-wide AOO launch and improve asset effectiveness  
Step 10 establish an asset management program for operators  
Step 11 establish a program for the maintainers  
Step 12 provide output and maintenance training  
Step 13 develop a designing for maintainability program  
Step 14 implement AOO outcomes immediately  
Step 15 perform one-off tasks  
Step 16 continuous improvement  
Step 17 AOO progress audit  
Main outcomes of Chapter Eight

## Bibliography