
Debottlenecking Choices: Throughput Constraints, Upgrades and Investment Cases Training Course

21 – 25 December 2026
Tokyo





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Programme Summary

Debottlenecking is the subject of this one-week training course for plant managers, operations directors and engineering managers, ending in a debottlenecking investment case for one process plant. Many plants add capacity step by step without testing which constraint limits output, so spend lands on equipment that is not the bottleneck. The programme moves from the principles of throughput constraints, through diagnosis of the limiting step, to design of upgrade options and investment cases, and then to application. Mars Training Centre UK delivers this debottlenecking programme for leaders from mixed organisations.

The Business Case

A plant produces only as much as its most limiting step allows. When constraints are found by habit or by the loudest complaint, capital is spent on equipment that does not raise output, and real constraints move elsewhere after each upgrade. Leaders who can locate the true constraint, compare optimisation, upgrade and revamp options and test the case before approval spend with more precision.

- Plant Throughput: Improves as spend is directed at the step that limits output.
- Capital Efficiency: Strengthens as options are compared on the same basis before approval.
- Project Risk Control: Falls as revamp scope, interfaces and change reviews are set early.

Principles and Evidence Base

- Theory of Constraints Goldratt: It frames the focusing steps applied to the constraint search in Sessions 1 and 2.
- Bottleneck analysis and capacity utilisation: They structure the capacity profile and the gap review in Session 2.
- Process simulation for capacity studies: It supports the option testing in Session 3.
- Stage-gate project development with front-end loading: It guides the investment case and scope definition in Session 4.

Intended Participants

- Plant managers who answer for output, cost and reliability of a process unit.
- Operations directors who decide where capacity effort and capital go.
- Engineering managers who shape revamp scope and technical options.
- Project leaders who carry upgrade proposals through approval.

Typical functions include refining, chemicals, fertilisers and food processing operations.



Learning Outcomes

1. Participants will be able to distinguish a true throughput constraint from a symptom or a local limit.
2. Participants will be able to diagnose the limiting step of a process plant from operating and capacity data.
3. Participants will be able to evaluate operating changes, debottlenecking upgrades and revamps against one another.
4. Participants will be able to construct an investment case that states assumptions, risks and next constraint.
5. Participants will be able to prioritise a sequence of projects by gain and readiness.
6. Participants will be able to justify a debottlenecking investment case to executive colleagues.

Programme Structure

Day 1: Debottlenecking Principles and Throughput Constraints

What limits the output of a process plant, and how is it found?

- Plant Capacity Definition Sheet
- Five Focusing Steps Checklist
- Constraint Versus Symptom Test
- Throughput and Utilisation Ratio Table
- Production Loss Tree

Day 2: Diagnosing the Limiting Step

Which step limits output today, and by how much?

- Unit-by-Unit Capacity Profile
- Bottleneck Ranking Table
- Design Versus Actual Rate Gap Review
- Hidden Constraint Interview Guide
- Next Constraint Forecast

Day 3: Designing Optimisation, Upgrade and Revamp Options

Which option removes the constraint at acceptable cost and risk?

- Operating Change Options List
- Debottlenecking Upgrade Option Sheet
- Revamp Scope Boundary Map
- Simulation Case Definition Template
- Option Comparison Matrix



Day 4: Investment Cases, Sequencing and Project Controls

How are options turned into a case that can be approved and delivered?

- Stage-Gate Decision Checklist
- Front-End Scope Definition Sheet
- Benefit and Cost Evidence Table
- Management of Change Review Form
- Project Sequence Roadmap

Day 5: Applying Debottlenecking to One Process Plant

Does the investment case hold when tested against every earlier session?

- Applying the Session 1 Constraint Test to the Plant
- Testing the Session 2 Capacity Profile on Live Data
- Comparing the Session 3 Options on Gain and Risk
- Rehearsing the Session 4 Gate Review
- Completing the Debottlenecking Investment Case

Methodology

The programme uses a structured exercise method built on anonymised plant rate sheets, loss records, process flow diagrams and short written cases from refining, chemicals and food processing. Participants analyse the data in small groups, take a position on the constraint and defend it to peers who act as finance and operations colleagues. Facilitator feedback is given on every work product before it enters the investment case.

- Suggested activity: Ranking six units by capacity margin and naming the likely constraint.
- Suggested activity: Comparing a debottlenecking upgrade with a larger revamp on gain, cost and risk.
- Suggested activity: Defending an investment case in a mock gate review.

Capstone Output

Each participant completes a debottlenecking investment case for one process plant. It holds a capacity profile, a constraint ranking, an option comparison, a scope and risk statement and a project sequence. The case is used at work to seek executive agreement on the next improvement step and to brief engineering teams.



Frequently Asked Questions

Is debottlenecking suitable for managers who have not led a capacity project before?

Yes. Debottlenecking is taught from first principles and assumes responsibility for a plant, unit or project, not earlier revamp experience.

Which models does debottlenecking rest on in this programme?

Debottlenecking here rests on the Theory of Constraints, bottleneck analysis, process simulation for capacity studies and stage-gate project development.

How is the investment case from debottlenecking used at work?

You use the investment case to seek executive agreement on the next improvement step, order projects by gain and brief engineering teams.

How does debottlenecking differ from a programme on plant maintenance planning?

Debottlenecking centres on raising output by removing the limiting step, while maintenance planning centres on keeping equipment available.