



GSOE9820 – Engineering Project Management

Corey Martin

Never Stand Still

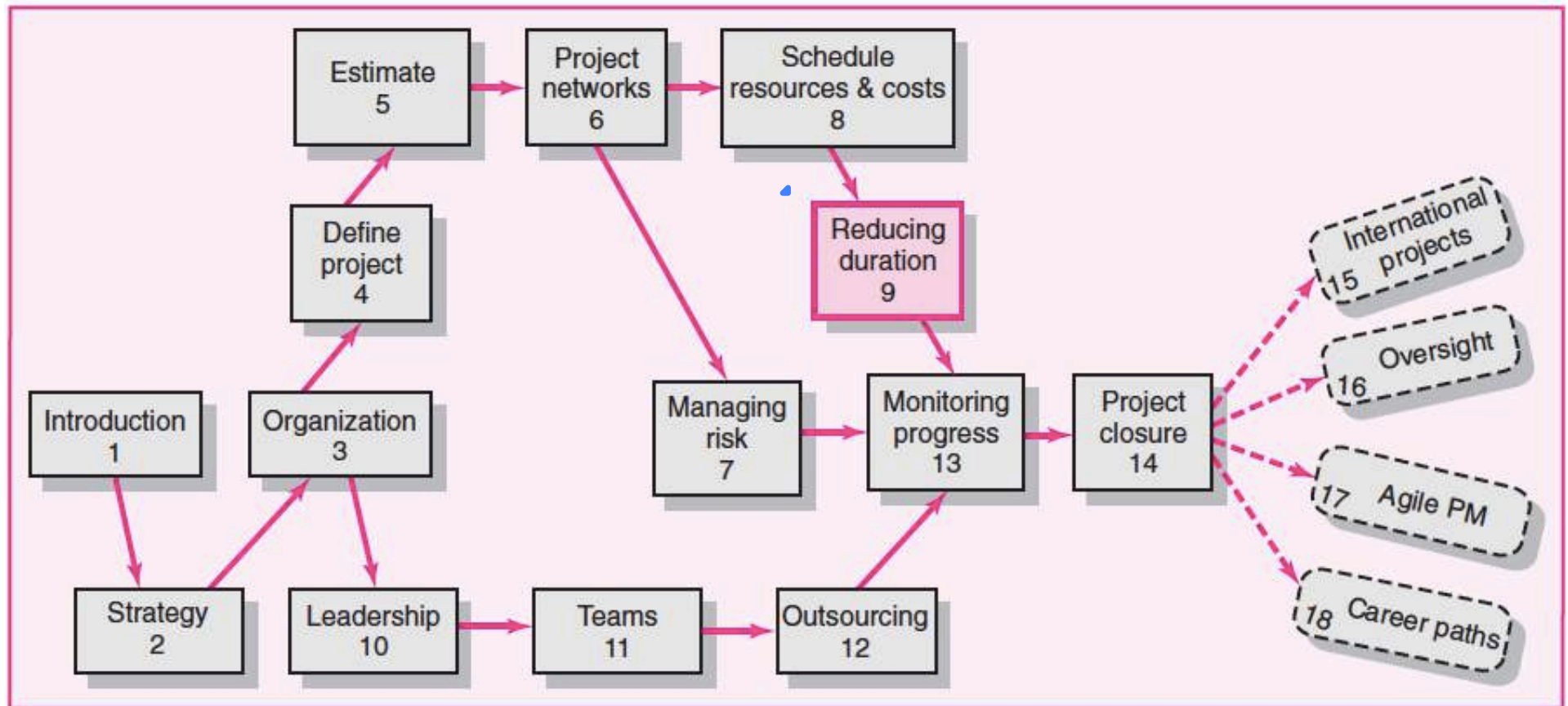
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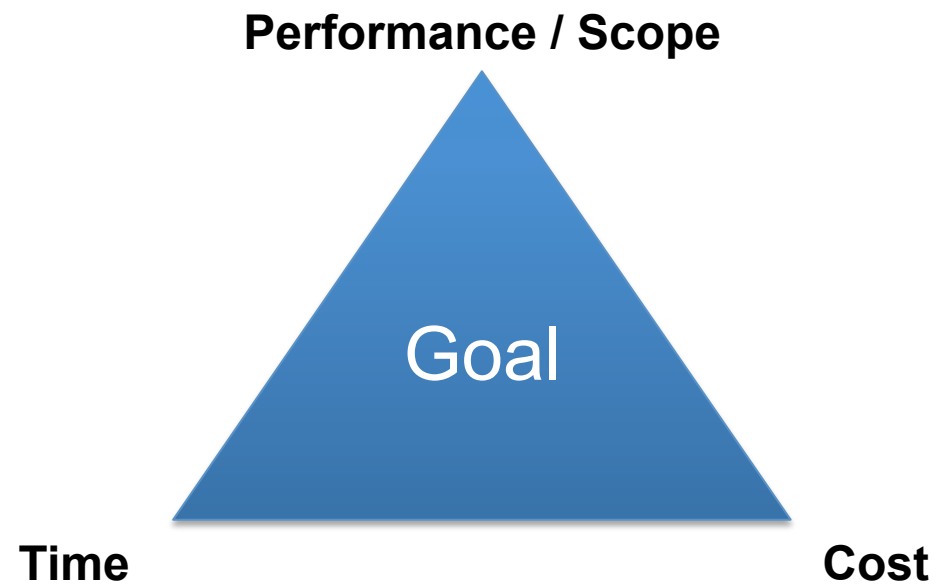
# Week 8 - Part I

## Reducing Project Duration

# Course Roadmap



# Triple Constraint Model



# Reasons for reducing duration

- Time-to-market pressures
- Unforeseen delays
- Incentive contracts (bonuses for early completion)
- Imposed deadlines and contract commitments
- Overhead and public goodwill costs
- Pressure to move resources to other projects

# Options for accelerating completion

## When resources are **not** constrained

Adding resources

Outsourcing project work

Scheduling overtime

Establishing a core project team

Do it twice—fast and then correctly

## When resources are constrained

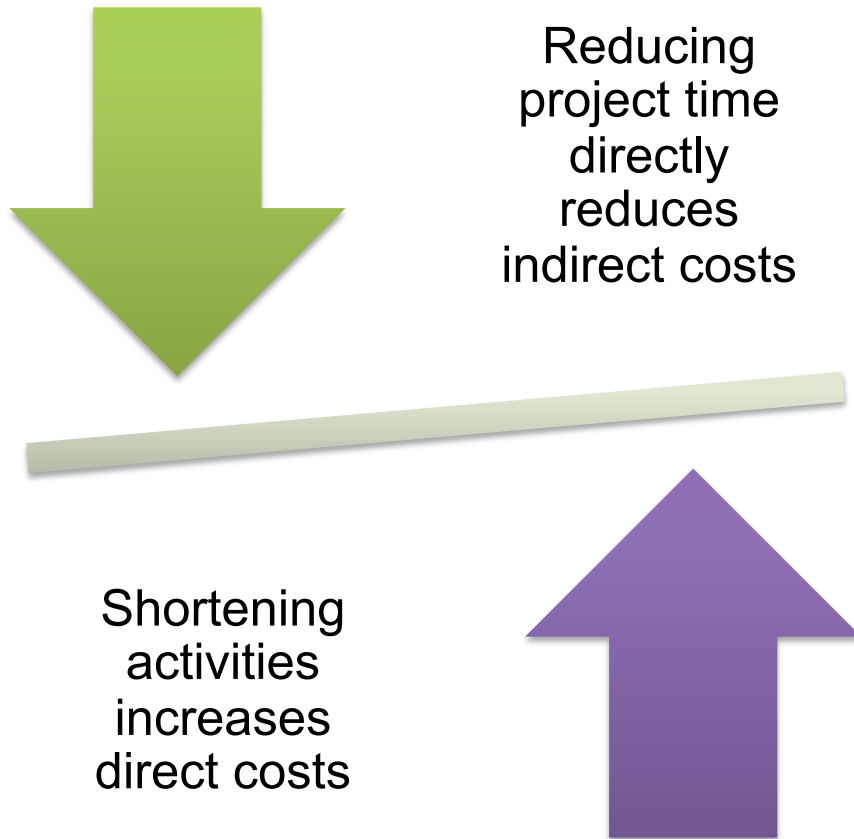
Fast-tracking

Critical chain

Reducing project scope

Compromise quality

# Consequences of reducing time



# Types of project costs

## Direct costs

- Costs that are clearly chargeable to a specific work package
- E.g. labour, materials, equipment and other

## Direct (project) overhead costs

- Costs incurred that are directly tied to an identifiable project deliverable or work package
- E.g. salary, rents, supplies, specialised machinery

## Indirect (general and administrative) overhead costs

- Organisation costs indirectly linked to a specific package that are apportioned to the project
- Costs that cannot be associated with any particular work package or project activity.  
E.g. supervision, administration, consultants and interest

# Critical path

The ***Critical path*** is:

- the **longest path** through the activity network that allows for the completion of all activities;
- the **shortest expected time** in which the entire project can be completed.



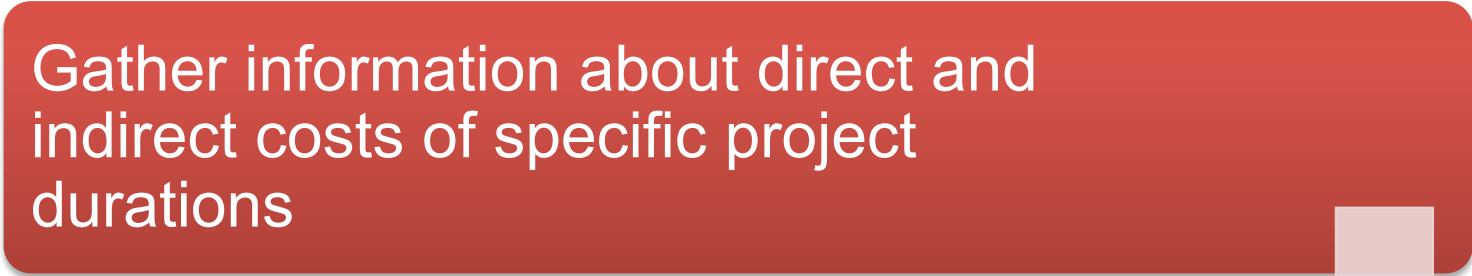
# “Crashing” strategy

Look first to reducing activities on the critical path to shorten overall duration of the project.



# Process of reducing project duration to reduce project cost

Gather information about direct and indirect costs of specific project durations



Search critical activities for lowest direct-cost activities to shorten project duration



Compute total costs for specific durations and compare to benefits of reducing project time



# Project Cost-Duration graph

Is a tool to quickly and logically compare the benefits of reducing project time with cost

Can be used before the project begins as well as while the project is in progress



# Key terms

Term	Definition
<b>Normal time</b>	Is the low-cost, realistic, efficient method for completing an activity under normal conditions
<b>Crashing</b>	Means shortening an activity
<b>Crash time</b>	Is the shortest possible time that an activity can realistically be completed in
<b>Crash cost</b>	Is the direct cost for completing an activity within the crash time
<b>Crash point</b>	Represents the maximum time an activity can be compressed/reduced.

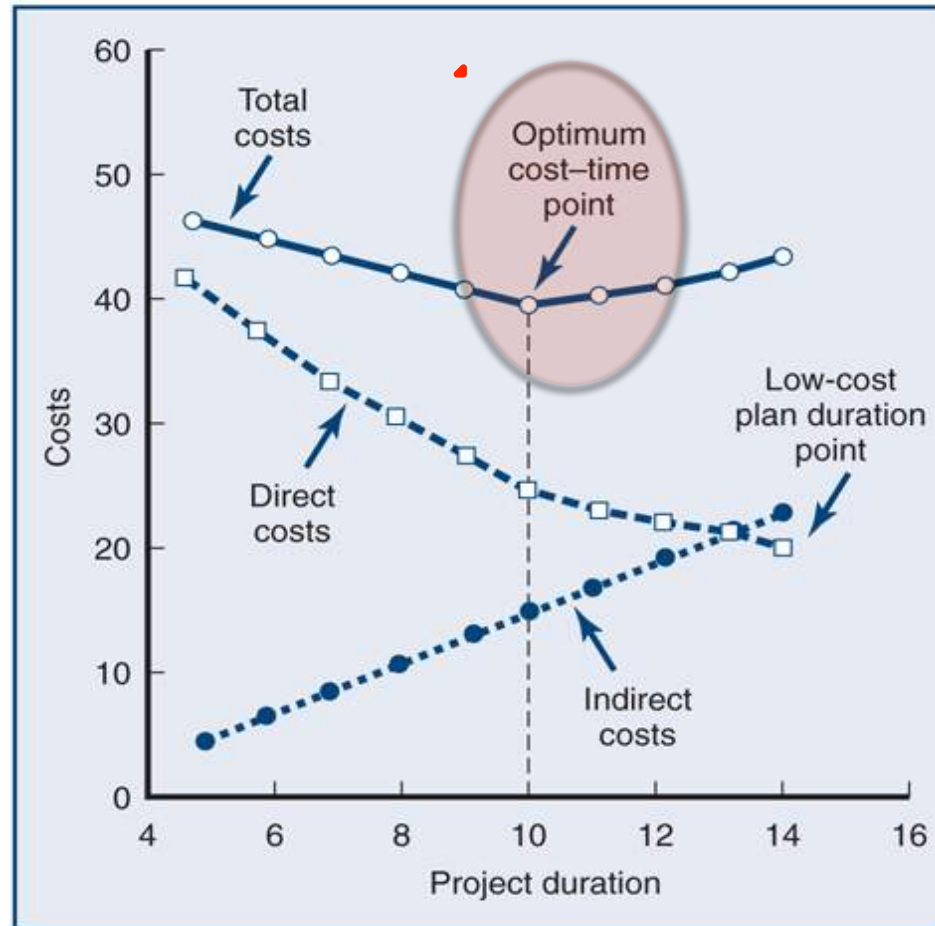
# Constructing a project cost–duration graph



# Project Cost–Duration graph

Figure 9.1

PROJECT COST–DURATION GRAPH



# Determining which activities to shorten

Shorten critical activities which will incur the least cost.

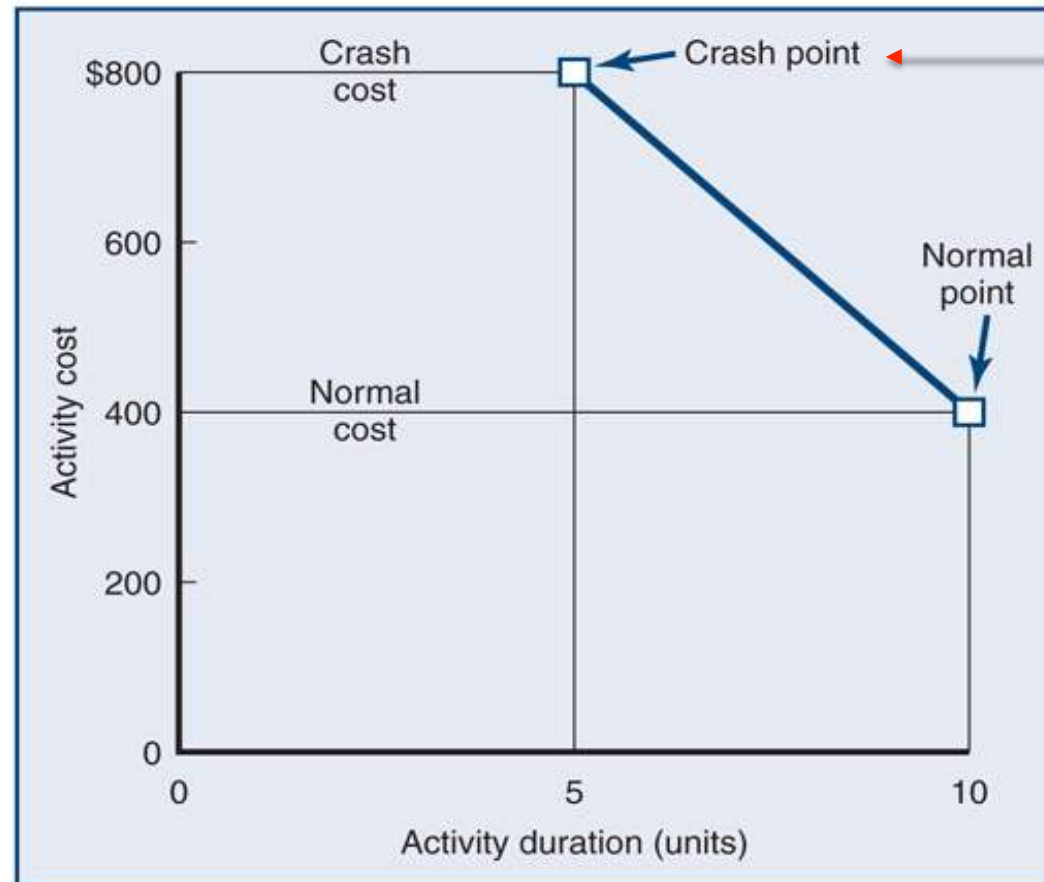
this could also be said as

- Shorten the critical activities with the smallest increase in cost per unit of time



# Activity cost-duration graph

Figure 9.2 ACTIVITY GRAPH



Represents the maximum time that an activity can be compressed

Is the original low-cost, early-start schedule



# Assumptions for activity graphs

- The cost relationship is linear
- Normal time assumes low-cost, efficient methods to complete the activity
- Crash time represents a limit—the greatest time reduction possible under realistic conditions
- Slope represents a constant cost *per unit of time*
- All accelerations must occur within the normal and crash times.

# Activity Cost Slope Equation

The slope of the activity graph indicates the cost per unit of time for that activity.

$$\text{Cost Slope} = \frac{\text{Rise}}{\text{Run}}$$

$$\text{Cost Slope} = \frac{\text{Crash Cost} - \text{Normal Cost}}{\text{Normal Time} - \text{Crash Time}}$$

# Impact of Project Crashing

**Reducing the project duration increases the risk of being late**

Project Crashing means that slack on non-critical activities will be reduced. Which means the chance of new critical paths occurring increases. Hence, the risk of the project becoming late increases.

- Reduces flexibility by using slack
- Can increase number of critical activities
- Can increase interdependencies of paths
- Makes resource scheduling tighter (critical)
- May increase costs



# Practical considerations

Using the project cost–duration graph

- Great tool especially at beginning of project.
- Indirect cost is not forgotten

Crash times

- Difficult task to estimate maximum amount of crash time

Linearity assumption

- Not perfect but good enough. Reduces complexity

Choice of activities to crash need to be revisited

- Cost, Risk, Resources and Timing all need to be considered

Time reduction decisions and sensitivity

- Evaluate benefit against risk and cost before making decision

# What if cost and not time is the issue?

## Commonly used options for cutting costs

- reduce project scope
- have owner take on more responsibility
- outsource project activities or even the entire project
- brainstorm cost savings options (innovation)