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# EBU5608 Product Development and Management

## Topic 15 – Managing Product Development Projects

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# Today Agenda

- Define what is project management
- Understand and represent different tasks in projects
- Undertake a baseline project plan
- Do project scheduling
- Accelerate projects
- Execute projects



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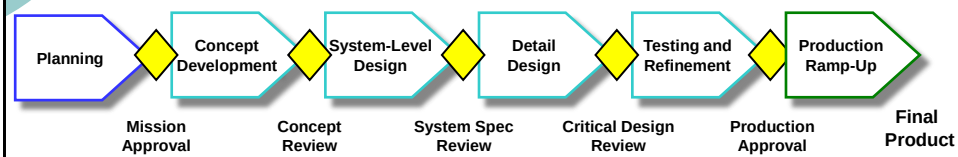
# A generic product development process

Project management is necessary throughout the development process




*Source: Product Design and Development, Karl T Ulrich and Steven D Eppinger, International Edition (3rd) McGraw-Hill, 2012, page 14*

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# Project Management

- For all but the simplest products, product development involves many people completing many different tasks.
- Successful product development projects result in high-quality, low-cost products while making efficient use of time, money, and other resources.
- **Project management** is the process of planning and coordinating resources and tasks to achieve these goals.



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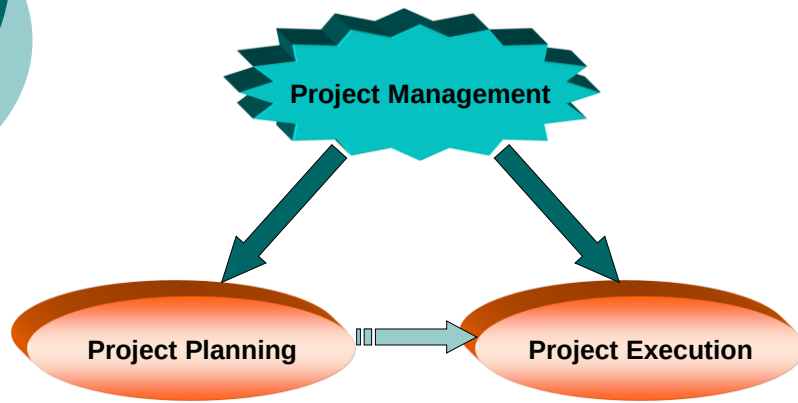
# Two Phases of Project Management



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# Two Phases of Project Management

- **Project planning** involves scheduling the **project tasks** and determining **resource requirements**.
- The **project plan** is first laid out during the concept development phase, although it is a dynamic entity and continues to evolve throughout the development process.
- **Project execution**, sometimes called ***project control***, involves coordinating and facilitating the myriad tasks required to complete the project in the face of inevitable unanticipated events and the arrival of new information. Execution is just as important as planning;
- Many teams fail because they do not remain focused on their goals for the duration of the project.



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# Understanding and Representing Tasks

Product development projects involve the completion of hundreds or even thousands of tasks.

There are different ways to represent the tasks in a project:

- **Sequential, Parallel, and Coupled Tasks**
- **The Design Structure Matrix**
- **Gantt Chart**
- **PERT Charts**
- **The Critical Path**

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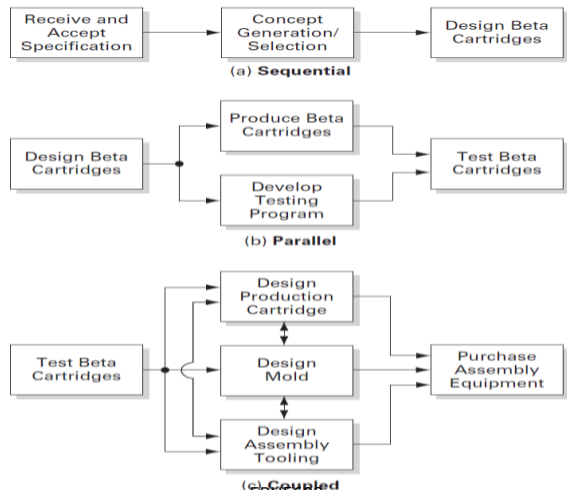
# Sequential, Parallel, and Coupled Tasks





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# Design Structure Matrix

- This is a useful tool for **representing** and **analysing task dependencies** is the *design structure matrix* (DSM).
- This representation was originally developed by Steward (1981) for the analysis of design descriptions and has more recently been used to analyze development projects modeled at the task level.
- The DSM is most useful when the tasks are listed in the order in which they are to be executed. In most cases, this order will correspond to the order imposed by sequential dependencies.

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# An example of a list of tasks

| Task | |
|---|---|
| Receive and accept specification | A |
| Concept generation/selection | B |
| Design beta cartridges | C |
| Produce beta cartridges | D |
| Develop testing program | E |
| Test beta cartridges | F |
| Design production cartridge | G |
| Design mold | H |
| Design assembly tooling | I |
| Purchase assembly equipment | J |
| Fabricate molds | K |
| Debug molds | L |
| Certify cartridge | M |
| Initial production run | N |





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# Working of a DSM model

A DSM model works as follows:

- A project task is assigned to a row and a corresponding column.
- The rows and columns are named and ordered identically, although generally only the rows list the complete names of the tasks. Each task is defined by a row of the matrix.
- We represent a task's dependencies by placing marks in the columns to indicate the other tasks (columns) on which it depends.

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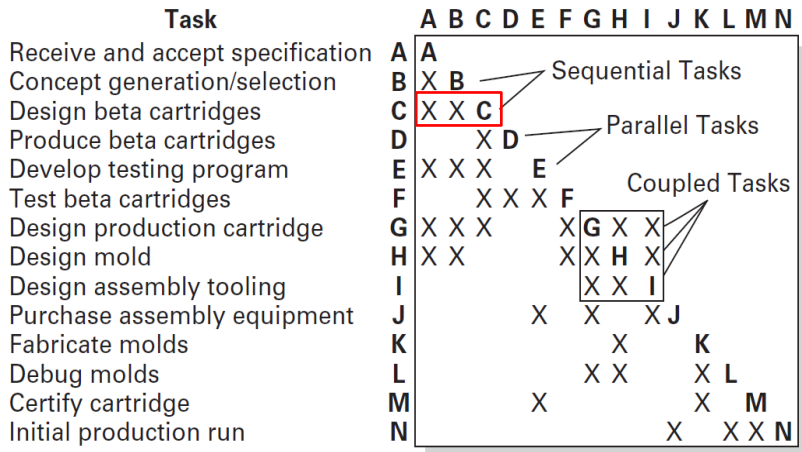
# An example of DSM





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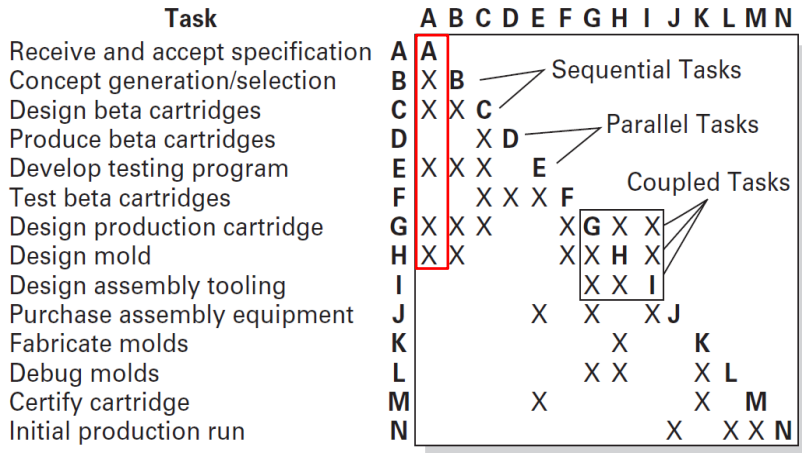
# An example of DSM



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- Reading across a row reveals all of the tasks whose output is required to perform the task corresponding to the row.
- Reading down a column reveals which tasks receive information from the task corresponding to the column.
- The diagonal cells are usually filled in with dots or the task labels, simply to separate the upper and lower triangles of the matrix and to facilitate tracing dependencies.



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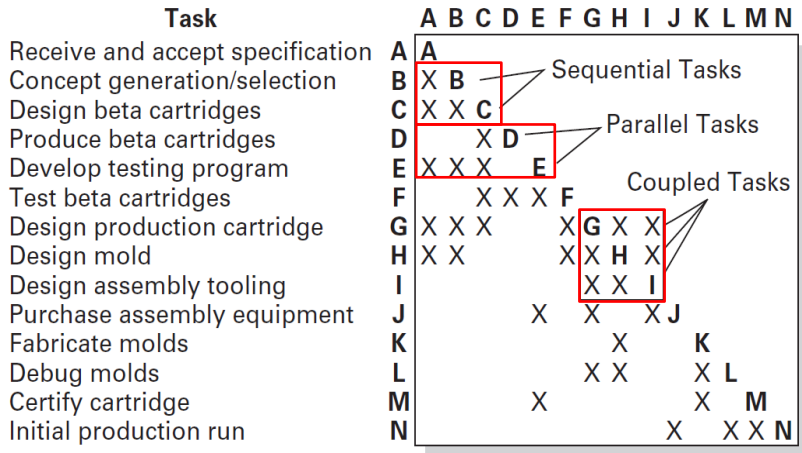
# An example of DSM



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# Gantt chart

- First used in **1910**
- Gantt charts show how the work is broken down into a set of **activities**
- They show the **scheduling** of these activities as a series of horizontal bands against a series of vertical lines representing dates
- They can be used to show **dependencies** between activities
- They can be used to measure **progress** on a project or compare planned **production** with actual production



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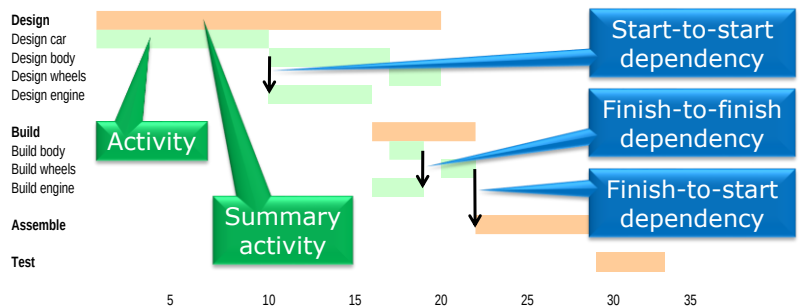
# Gantt chart – an example



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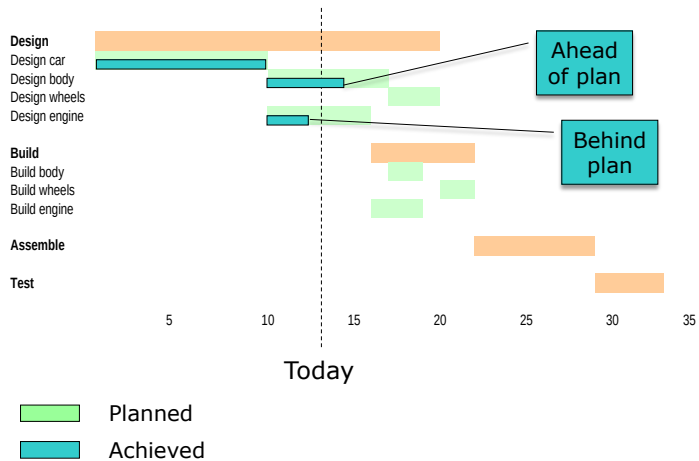
# Gantt charts – progress tracking



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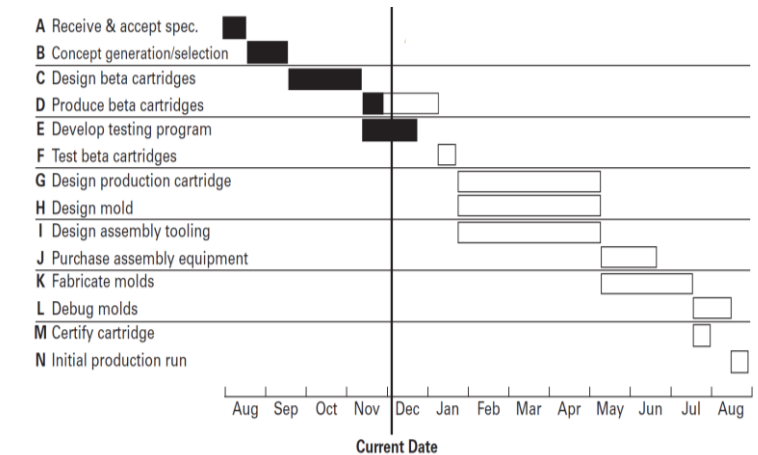

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# PERT Charts

- **PERT** (program evaluation and review technique) charts explicitly represent both dependencies and timing, in effect combining some of the information contained in the DSM and Gantt chart.
- While there are many forms of PERT charts, we prefer the "activities on nodes" form of the chart, which corresponds to the process diagrams that most people are familiar with.



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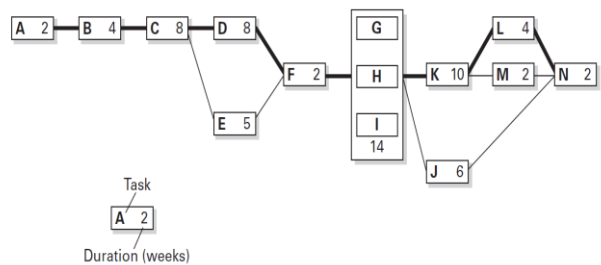
# PERT Charts & Critical Path Method

**EXHIBIT 18-5**
PERT chart for the Cheetah project. The critical path is designated by the thicker lines connecting tasks. Note that tasks G, H, and I are grouped together because the PERT representation does not depict coupled tasks explicitly.

| | |
|---|---|
| A Receive & accept specification | H Design mold |
| B Concept generation/selection | I Design assembly tooling |
| C Design beta cartridges | J Purchase assembly equipment |
| D Produce beta cartridges | K Fabricate molds |
| E Develop testing program | L Debug molds |
| F Test beta cartridges | M Certify cartridge |
| G Design production cartridge | N Initial production run |



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- The blocks in the PERT chart are labelled with both the task and its expected duration. Note that the PERT representation does not allow for loops or feedback and so cannot explicitly show iterative coupling. As a result, the coupled tasks G, H, and I are grouped together into one task.
- The graphical convention of PERT charts is that all links between tasks must proceed from left to right, indicating the temporal sequence in which tasks can be completed. When the blocks are sized to represent the duration of tasks, as in a Gantt chart, then a PERT diagram can also be used to represent a project schedule.



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# The Critical Path

- The **dependencies** among the tasks in a PERT chart, some of which may be arranged sequentially and some of which may be arranged in parallel, lead to the concept of a *critical path.*
- The **critical path** is the longest chain of dependent events. This is the single sequence of tasks whose combined required times define the minimum possible completion time for the entire set of tasks.

# PERT Charts & Critical Path Method

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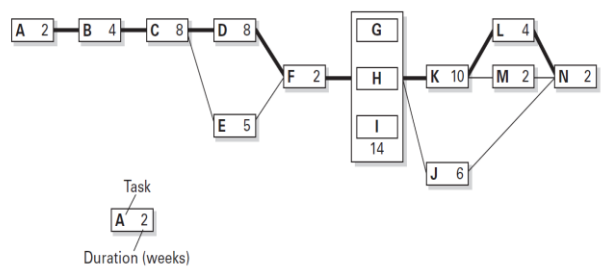






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- Identifying the **critical path** is important because a delay in any of these *critical tasks* would result in an increase in project duration. All other paths contain some *slack,* meaning that a delay in one of the noncritical tasks does not necessarily create a delay for the entire project.

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# Baseline Project Planning

- The **project plan** is the roadmap for the remaining development effort. The plan is important in coordinating the remaining **tasks** and in estimating the required development **resources** and development **time**.
- Some measure of project planning occurs at the earliest stages of product development, but the importance of the plan is highest at the end of the concept development phase, just before significant development resources are committed.



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# Method for creating a Baseline Project Plan

- Contract Book
- Project Task List
- Team staffing & Organisation
- Project Schedule
- Project Budget
- Project Risk Plan
- Modifying the baseline plan

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# What is a Project Schedule?

- The **project schedule** is the merger of the project tasks and the project time line.
- The schedule identifies when major project **milestones** are expected to occur and when each project task is expected to begin and end.
- The team uses this schedule to track **progress** and to orchestrate the **exchange of materials and information** between individuals.
- It is therefore important that the schedule is viewed as credible by the entire project team.



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# Steps for a Baseline Project Schedule

The following steps are required to create a baseline project schedule:

1. Use the DSM or PERT chart to identify the **dependencies** among tasks.
2. Position the key project **milestones** along a time line in a Gantt chart.
3. Schedule the **tasks**, considering the project staffing and other critical **resources**.
4. Adjust the timing of the milestones to be consistent with the **time** required for the tasks.

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# Accelerating Projects

**Product development time** is often the dominant concern in project planning and execution. There are a set of guidelines for accelerating product development projects.

Accelerating a project before it has begun is much easier than trying to expedite a project that is already under way.



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# Guidelines for accelerating product development projects

These first set of guidelines applies to the project as a whole:

- Start the project early
- Manage the project scope
- Facilitate the exchange of essential information

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The second set of guidelines is aimed at **decreasing the time** required to complete the tasks on the critical path:

- Complete individual tasks on the critical path more quickly
- Aggregate safety times
- Eliminate some critical path tasks entirely
- Eliminate waiting delays for critical path resources
- Overlap selected critical tasks
- Pipeline large tasks
- Outsource some tasks



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The final set of guidelines is aimed **at completing coupled tasks more quickly**. Recall that coupled tasks are those that must be completed simultaneously or iteratively because they are mutually dependent:

- Perform more iterations quickly
- Decouple tasks to avoid iterations
- Consider set of solutions

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# Project Execution

Smooth execution of even a well-planned project requires careful attention. Three problems of project execution are particularly important:

(1) What mechanisms can be used to coordinate tasks?
(2) How can project status be assessed? and
(3) What actions can the team take to correct for undesirable deviations from the project plan?





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# Coordination Mechanisms

- Coordination among the activities of the different members of the team is required throughout a product development project. The need for coordination is a natural outgrowth of dependencies among tasks.
- Coordination needs also arise from the inevitable changes in the project plan caused by unanticipated events and new information.
- Difficulties in coordination can arise from inadequate exchanges of information and from organizational barriers to cross-functional cooperation.

Several mechanisms used by teams to address these difficulties and facilitate coordination are:

- Informal communications
- Meetings
- Schedule display
- Weekly display
- Incentives
- Process documents



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# Assessing Project Status

- Project leaders and senior managers need to be able to assess project status to know whether corrective actions are warranted.
- The project leader assesses project status during formal team meetings, by reviewing the project schedule, and by gathering information in informal ways.
- A team may also engage an expert from outside the core team to review the status of the project. The goal of these reviews is to highlight areas of risk and to generate ideas for addressing these risk areas.
- Project reviews, conducted by senior managers, are another common method of assessing progress.

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# Corrective Actions

After discovering an undesirable deviation from the project plan, the team attempts to take corrective action.

Some of the possible actions include:

- Changing the timing or frequency of the meetings
- Changing the project staff
- Locating the team together physically
- Soliciting more time and effort from the team
- Focussing more efforts on the critical tasks
- Engaging outside resources
- Changing the project scope or schedule



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# Post Mortem Project Evaluation

- **Postmortem project evaluation** or **postproject review** is usually an open-ended discussion of the strengths and weaknesses of the project plan, development processes employed, commercial and technical results, and quality of execution.
- This discussion is sometimes facilitated by an outside consultant or by someone within the company who was not involved in the project.

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Several questions help to guide the discussion:

- Did the team achieve the mission articulated in the mission statement (including strategic, technical, and financial goals)?
- Which aspects of project performance (development time, development cost, product quality, manufacturing cost, environmental impacts) were most positive?
- Which aspects of project performance were most negative?
- Which tools, methods, and practices contributed to the positive aspects of performance?



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- Which tools, methods, and practices detracted from project success?
- What problems did the team encounter?
- What specific actions can the organization take to improve project performance?
- What specific technical lessons were learned? How can they be shared with the rest of the organisation?

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# Summary

- **Project management** is the activity of planning and coordinating resources and tasks to achieve high-quality, low-cost products while making efficient use of time, money, and other resources.
- **Project planning** involves scheduling the project tasks and determining resource requirements.
- **Project execution**, sometimes called *project control,* involves coordinating and facilitating the myriad tasks required to complete the project in the face of inevitable unanticipated events and the arrival of new information.



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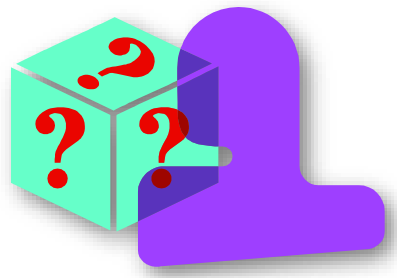
# Questions?



**Go to www.menti.com to post your questions**

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# Reading

- **Core Textbook** (Ulrich & Eppinger, 7th Edition)
  - Chapter 19. Project Management
    **pages 401 - 422**



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