CENG 6101 Project Management

Project Planning

Abraham Assefa Tsehayae, PhD

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TO DO

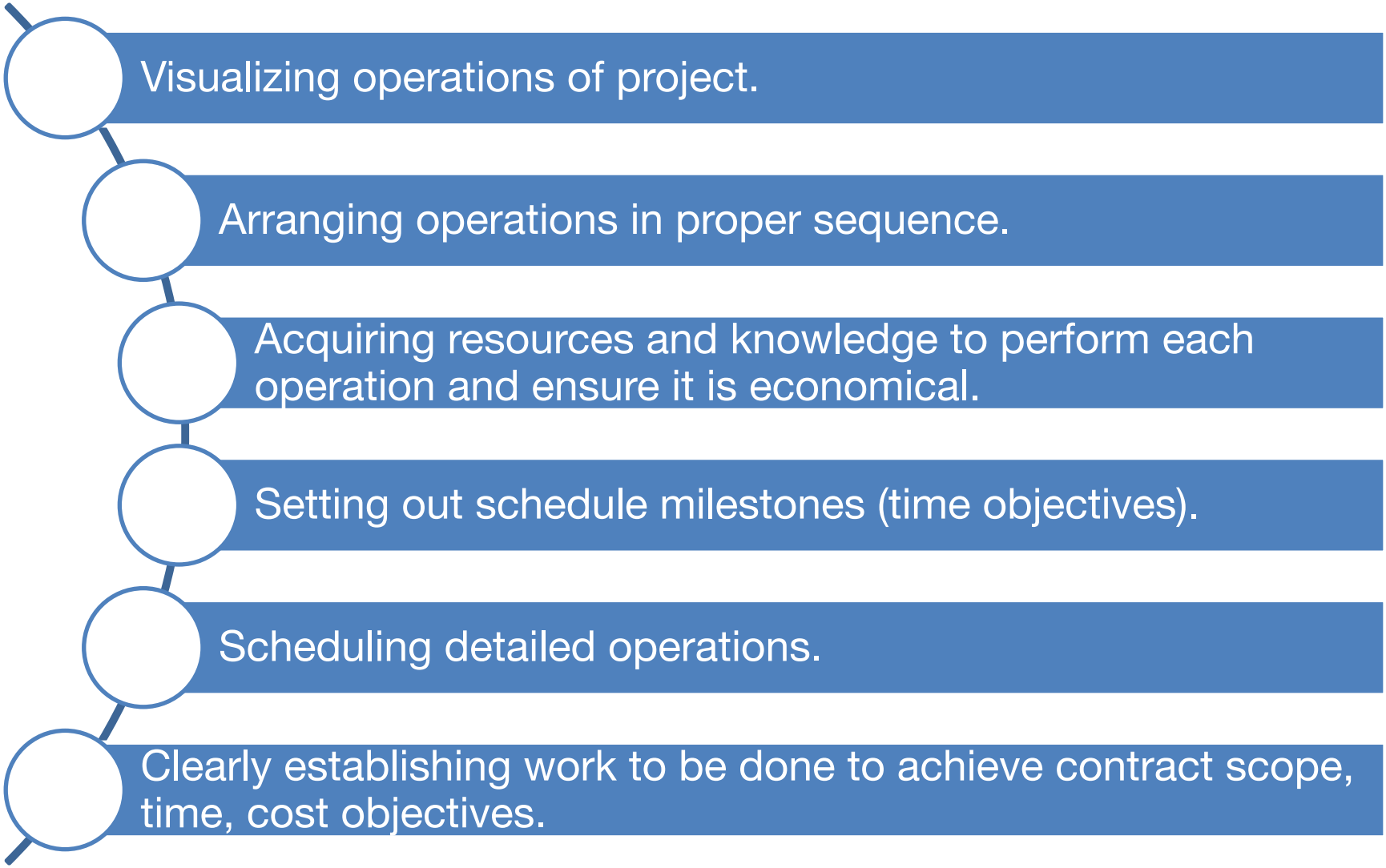
1. Why is planning and control necessary?
2. Steps for developing a plan
3. Types of Plans
4. Work breakdown structures and Organizational responsibility chart
5. Outputs from project plan development

Project Planning

- Planning is one of key functions of project management process and is Project manager's primary activity
- Involves selecting objectives and establishing programs and procedures for achieving objectives
- Must choose from alternatives for:
  - Systems
  - Equipment
  - Construction methods
  - Contract strategy
- Plan accomplished through structured sequence of events leads to desired objectives
  - Proactive
  - Reactive management

Project Planning

- What is involved in planning?



Project Planning

- Benefits of planning:

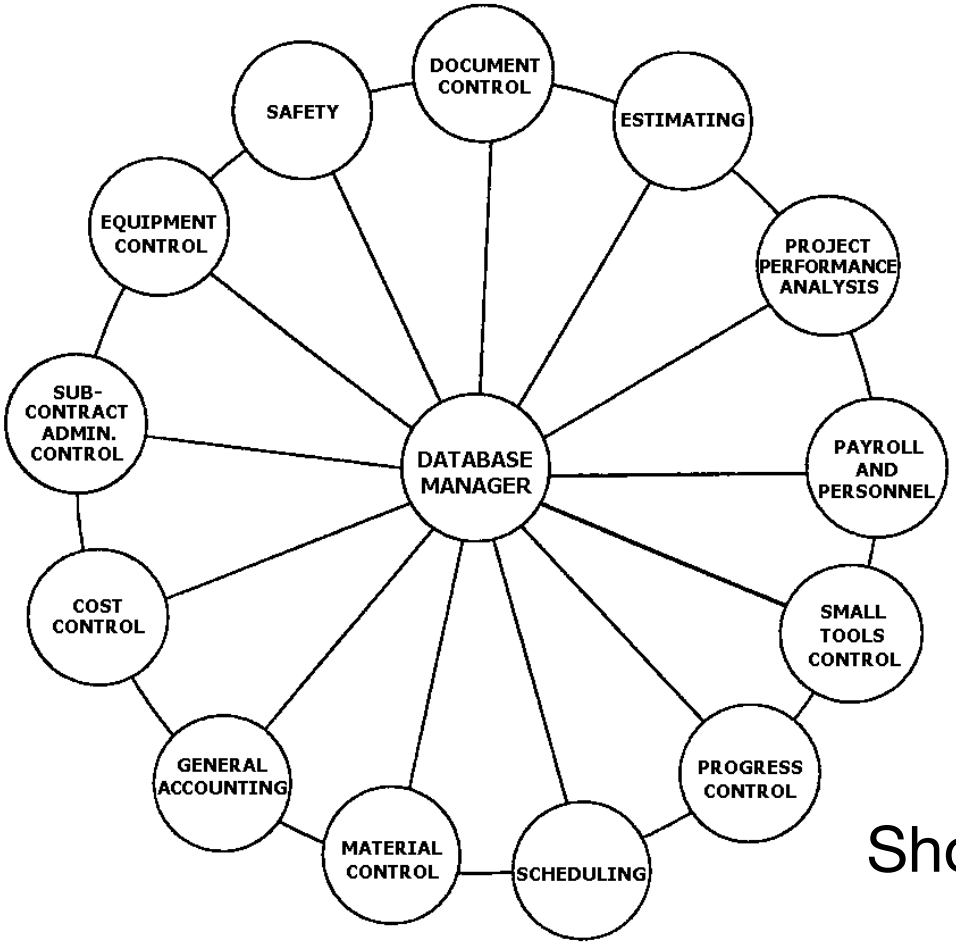
Project Planning

- Early and proper planning:
  1. Impact of decision made earlier in project is greater than decision made in later stage. e.g. decision to use CAD or BIM must be made early has implications throughout project life cycle
  2. May not be cost effective if decision made too late
  3. In conceptual and design stages, planning determines systems to be used, type of plans to be developed later, scope of physical project
  4. Detailed plans developed during execution and finish stages

Project Planning

- Project Systems:
- System = assemblage or combination of things or parts forming a complex or unitary whole (PMI)
  - Systems approach provides a solution for an identified need
  - System receives inputs from its environment and transforms them into maximum desired outputs
- Enable PM to communicate cross functionally
- Facilitate execution of project
- Support project team within project environment

Project Planning



Should add QC/QA

Construction Project Systems

Source (Ahuja et al. 1994)

Project Planning

- Project Systems:
- Key systems:
  1. Organisation
  2. Planning
  3. Management information
  4. Project control
  5. Construction methods/techniques

1. Organization

- Structure for personnel hiring/firing procedures and organisational/ individual responsibilities.
- Corporate or project level.

Project Planning

- Project Systems:

2. Planning:

- All plans, strategies, goals, schedules, resource allocation.

3. Information Management:

- Communications and retrieval for information for intelligent decision making (e.g. database manager).

4. Project Control:

- Gathering and disseminating data and information on costs, schedules, technical performance.

5. Construction Methods:

- Alternative methods of construction, constraints, assumptions, associated labour and material productivities

Project Planning

- Project Systems:
- Human element in systems impacts performance
- Must plan for which and how much of each system to use on a project
- Project uses corporate systems if in place or project-specific systems
- Most systems now computer-based high speed calculations and information transfers
  - KB, ES, NN, other forms of AI provide intelligent decision support
- Relational databases provide information to more than one system

Project Planning

- Why Project Planning?

1. Project size and complexity increasing with advanced technology

- Generates specialisation: e.g. structural, construction, mechanical, electric, etc.
- Need a plan to facilitate communication so that each party working towards same set of project objectives: time, cost, quality, scope, etc.
- Enables PM to emphasize and prioritize objectives and communicate them to project participants

2. Increasing importance of timely project completion

- For resource (revenue) industries, For market share for products, Use of computers reduces design time and increases need to plan and schedule

- Why Project Planning?

3. Resource limitations and need to optimize resource use to economise (e.g., labour resources in tight labour market)

4. Cost of capital: Need to get return on investment ASAP

5. Large element of risk with increasing technical complexity and price escalation: Financiers require documented schedules and estimates (workable plans) to substantiate ability to execute and control work

- Why Project Planning?

6. Coordination of shop drawing preparation and approval, delivery of materials and major equipment, completion of tests and inspections: Must be coordinated so as not to delay on-site activities or increase project costs

7. To account for effect of environment (inclement weather) and other unforeseen events: Need to develop contingency plans and update plan as project progresses

8. Establishes targets against which performance can be measured

9. Increase efficiency of project team members and therefore increases production

Project Planning

- Why Project Planning?

10. Provides continuity for a project and reduces learning period for new personnel (due to transient nature of construction personnel)

11. Provides a benchmark for measuring performance and establishing efficiency of project execution

12. Value of plan is in its implementation

- Progress measured against planned targets
- Schedule and cost deviations corrected or plan modified
- Control function just as important as initial plan

Steps for Developing a Plan

1. Identify all project elements, such as structure, foundation, electrical, and mechanical.
2. Identify all agencies participating in the project. Agencies include contractor's and owner's representative of any contracting party involved in the project.
3. Identify responsibilities for each project element within each participating agency such as engineering, procurement, and construction [Responsibility matrix].
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Steps for Developing a Plan

6. Identify responsibilities for each project element within each participating agency such as engineering, procurement, and construction [Responsibility matrix].
7. Identify each event, key point, and interface for which information is required such as completion of concrete pump base and delivery of pump.
8. Identify highest responsibility levels requiring information about each event, key point, or interface [Prior to beginning CPM calculations].

Types of Plans

- Schedules (time plans)
- Organizational and staffing
- Procurement
- Contracting
- Safety
- Materials and equipment management
- Total quality management (TQM)
- Communications
- Information
- Commissioning and Turnover
- Manufacturing
- Fabrication
- Promotional and publicity
- Maintenance
- Recognition, rewards, feedback
- Risk management
- Waste management
- Environmental
- Information management

WBS and ORC

- Work Breakdown Structure (WBS)
  - Breaks down scope of work into manageable pieces
  - Begins early in project, from initial scope statement, by designers
  - Develops in form of pyramid structure that expands downward as project develops
  - Later, contractors and subcontractors develop own WBS suited specifically to their needs, and becomes the subsets of overall or master plan/WBS

WBS and ORC

- Work Breakdown Structure (WBS)
- As design progresses, planner defines different parts of project plan
  - e.g. preliminary design – general divisions of work
  - e.g. detailed design – divisions broken down into subdivisions and further subdivisions = WBS
- WBS divides multi-project program into component projects, or complex project into components called work packages at lowest level
  - WBS helps planner deal with one manageable component at a time
  - Helps in developing project network (logic and timing)

- Work Breakdown Structure (WBS)

Preliminary WBS for Hydropower Project

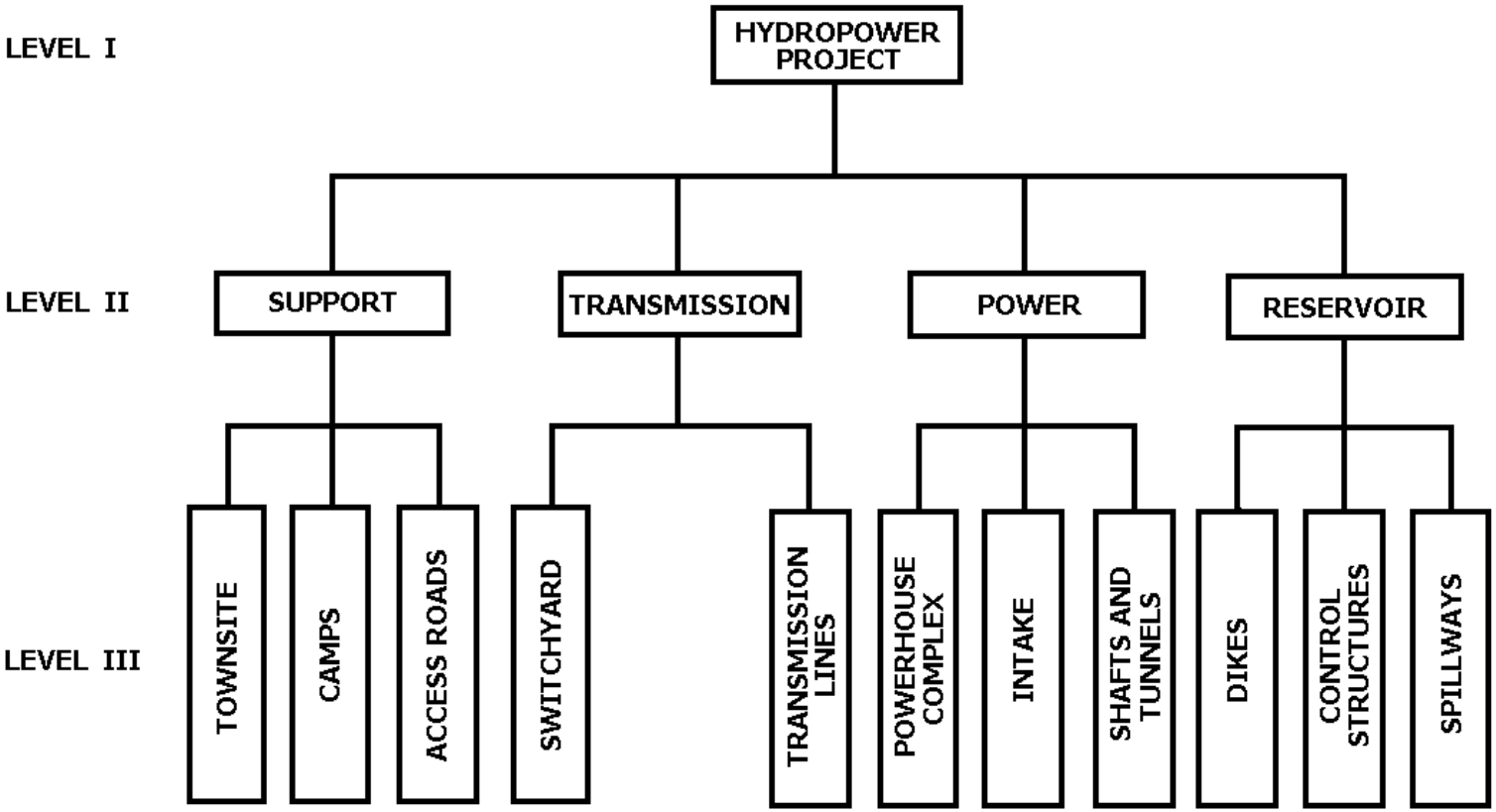


FIGURE 2.4

- Work Breakdown Structure (WBS)

WBS With More Detailed Design

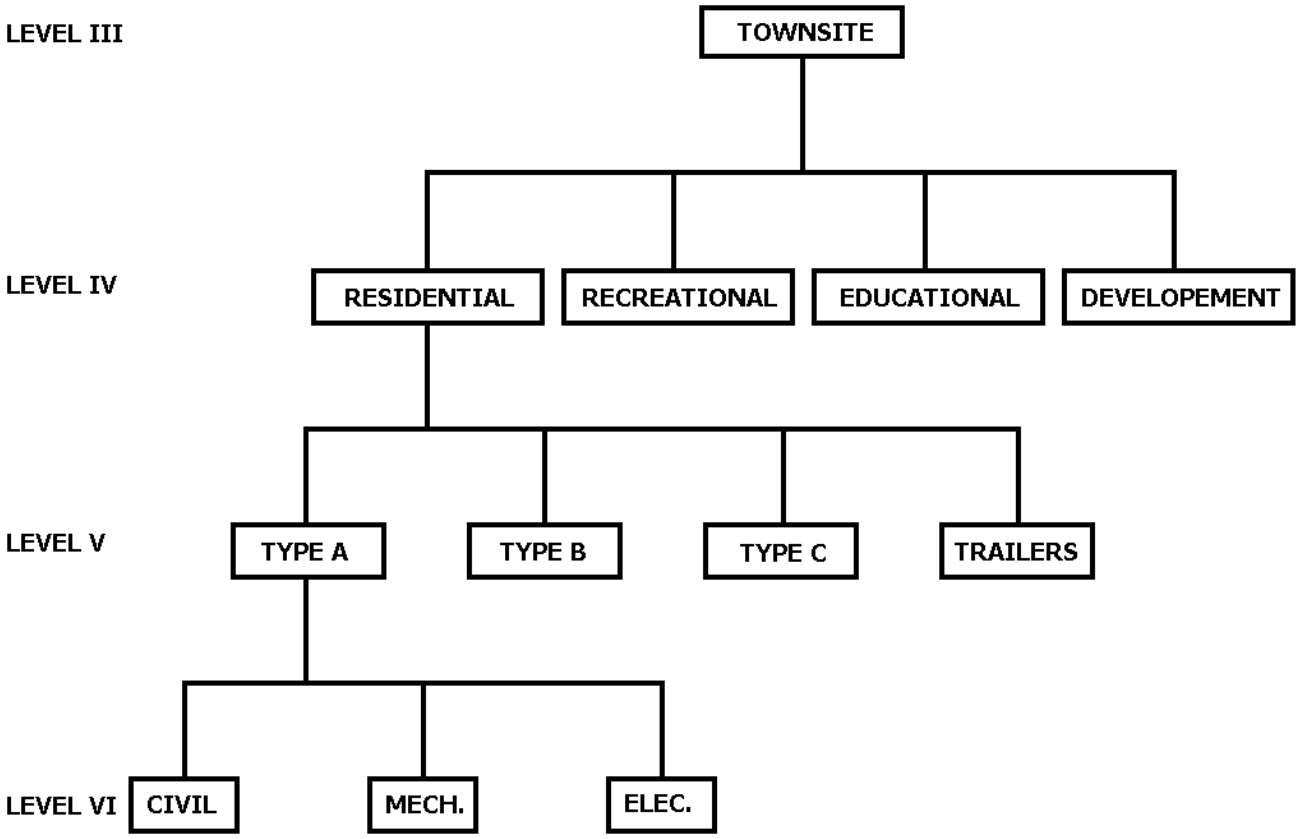


FIGURE 2.5 **Example of Work Breakdown Structure-Hydropower Project**

WBS and ORC

- Work Breakdown Structure (WBS)

– Lowest level (VI) are work packages assigned to a specific contractor or department in organisation for responsibility

– Work packages should be of manageable size for controlling and tracking during construction

– Contract package can consist of one or more work packages

– Size of contract package depends on bonding limitations, contractor capacity, expertise, commissioning requirements

WBS and ORC

- Work Breakdown Structure (WBS)
- Many ways to develop WBS and define work packages
- Subdivisions of WBS can be by:
  - geographic regions
  - construction site areas
  - process components
  - building elements
  - engineering and process systems
  - trades
  - departments

WBS and ORC

- Work Package: is a cost centre
  - →Has separate estimate budget and expenditure account
  - →Assigned a charge number (code of accounts)
  - →WBS for cost control (lowest level elements are cost accounts) can be integrated with schedule and cost information of project WBS

– Cost centres related to work packages (WP)

∴ Schedule and cost information can be derived by both owner and contractor from same database – ideal situation

– WBS provides framework for managerial control

– Simultaneously develop organisational tree and relate organisational units to WP to determine suitability of WBS

WBS and ORC

- Work Package:

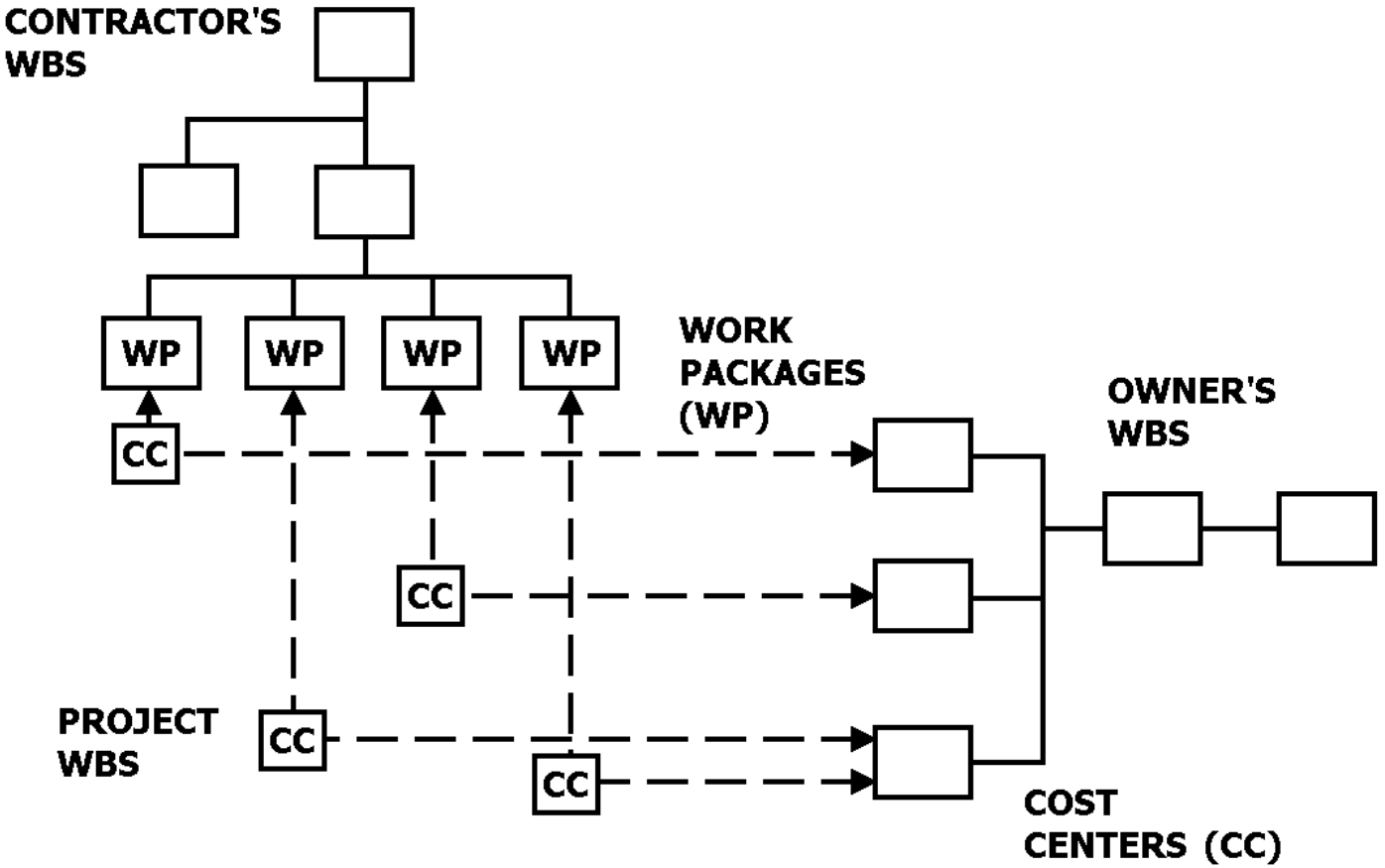


FIGURE 2.6 Overlay of Owner's and Contractor's Work Packages

WBS and ORC

- Organization Responsibility Chart:
  - Prime responsibility for each WP assigned to individual in PM team
  - Individual may be assigned >1 WP
    - e.g. project engineer, supervisor, coordinator, contract manager
  - Responsibility chart establishes communication and reporting links and authority structure in project

WBS and ORC

- Organization Responsibility Chart:

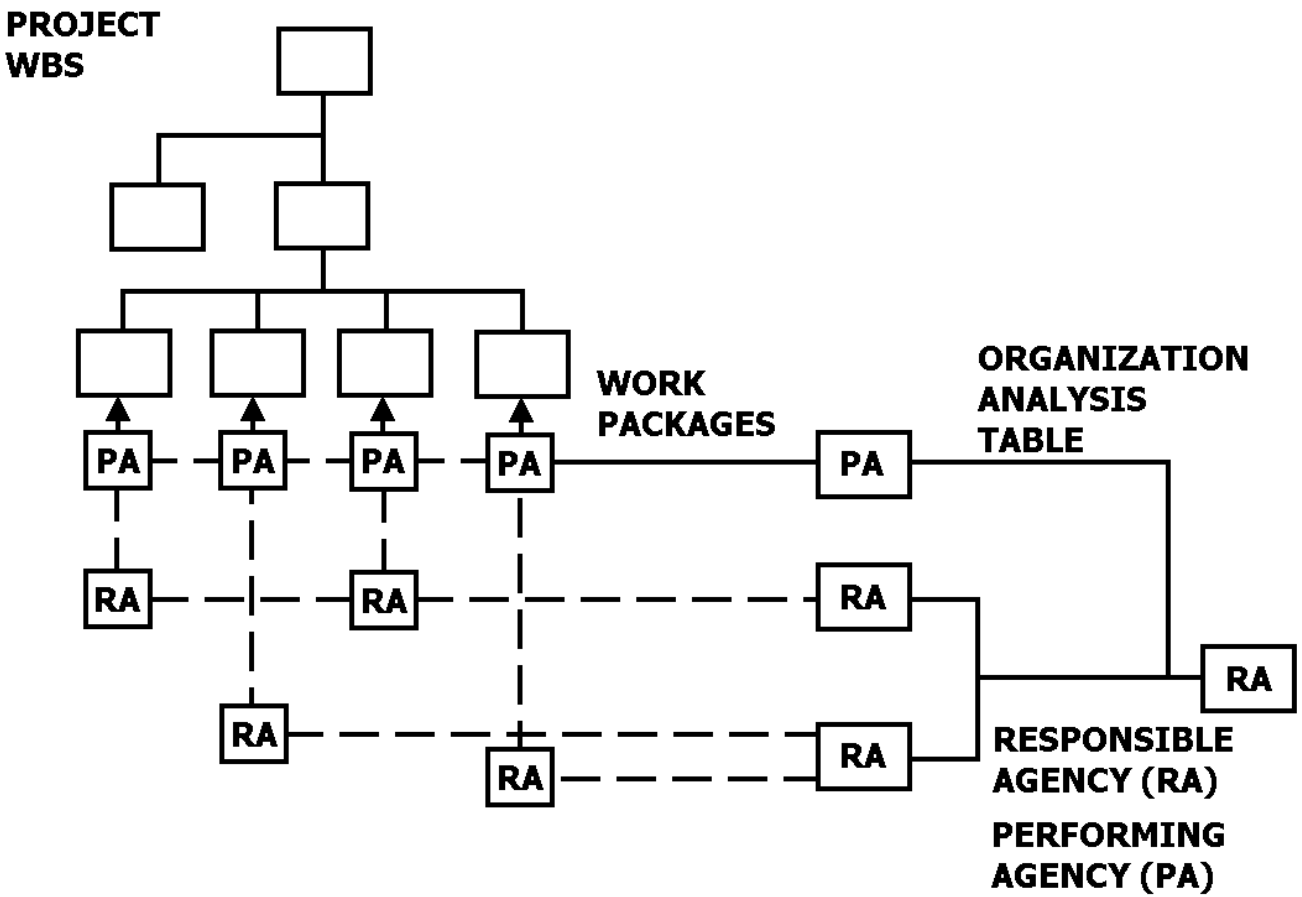


FIGURE 2.7 WBS/Responsibility Structure

WBS and ORC

- Organization Responsibility Chart:
- Overlay of organisational responsibility chart and WBS = Organisation Analysis Table (OAT)
- Responsible Agency (RA) = first line supervision
- Performing Agency (PA) = contractor's individual responsible for WP (also called contract packages)

– In most cases, simple to allocate responsibilities for work packages

∴ Do not need to draw organisational responsibility chart (ORC)

∴ Each WP has schedule and budget: Planning engineer should elicit input from those responsible for doing work and Assures "buy-in" to schedule (ownership)

Outputs from project plan development

1. Project charter.
2. Description of project management strategy – individual management plans.
3. Scope statement – project deliverables, project objectives
4. WBS at level at which control will be exercised.
5. Cost estimates, Scheduled start dates, Responsibility assignments (To level of WBS at which control will be exercised)
6. Performance measurement baselines for schedule and cost.
7. Major milestones and target dates.

Outputs from project plan development

8. Key or required staff.
9. Key risks and responses.
10. Individual management plans for scope, budget, schedule, safety, quality, etc.
11. Open issues and pending decisions.
12. Project organisation chart.
13. Significant constraints and assumptions.
14. Technical documentation: requirements, specifications, designs
15. Documentation of relevant standards.

Outputs from project plan development

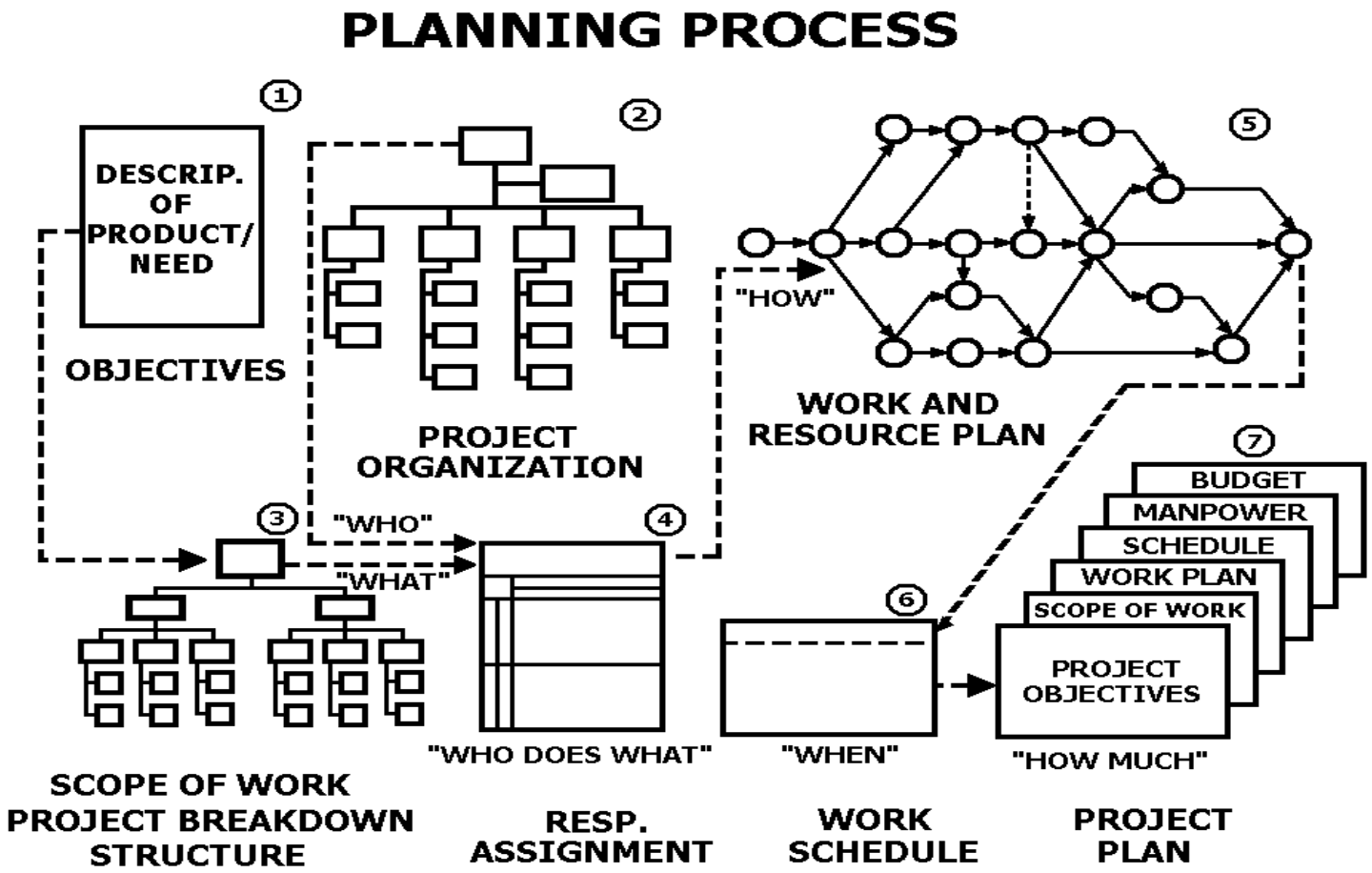


Figure 1 Overview of the Planning Process

Outputs from project plan development

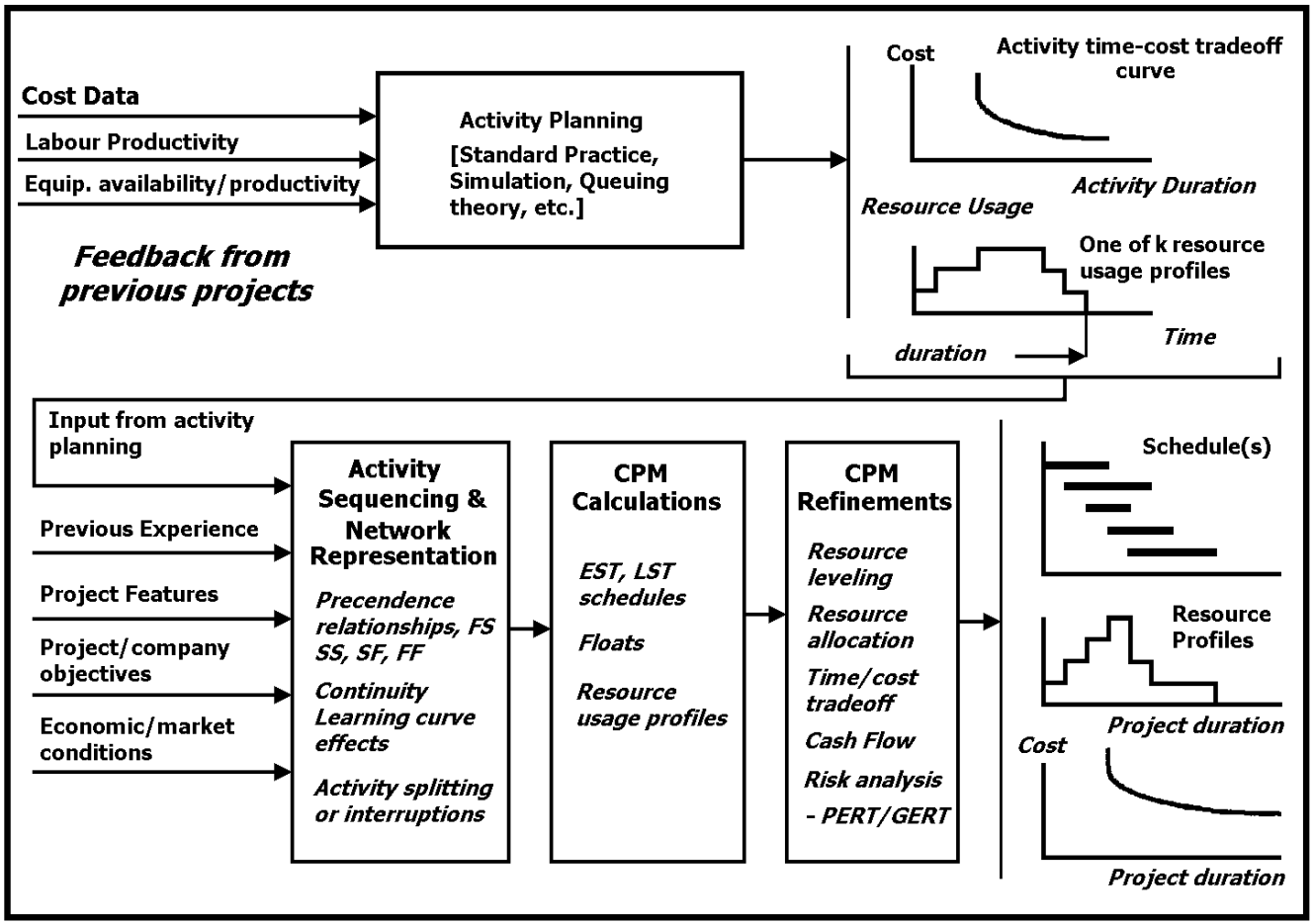


Figure 2 CPM Tools and Data Flows

Outputs from project plan development

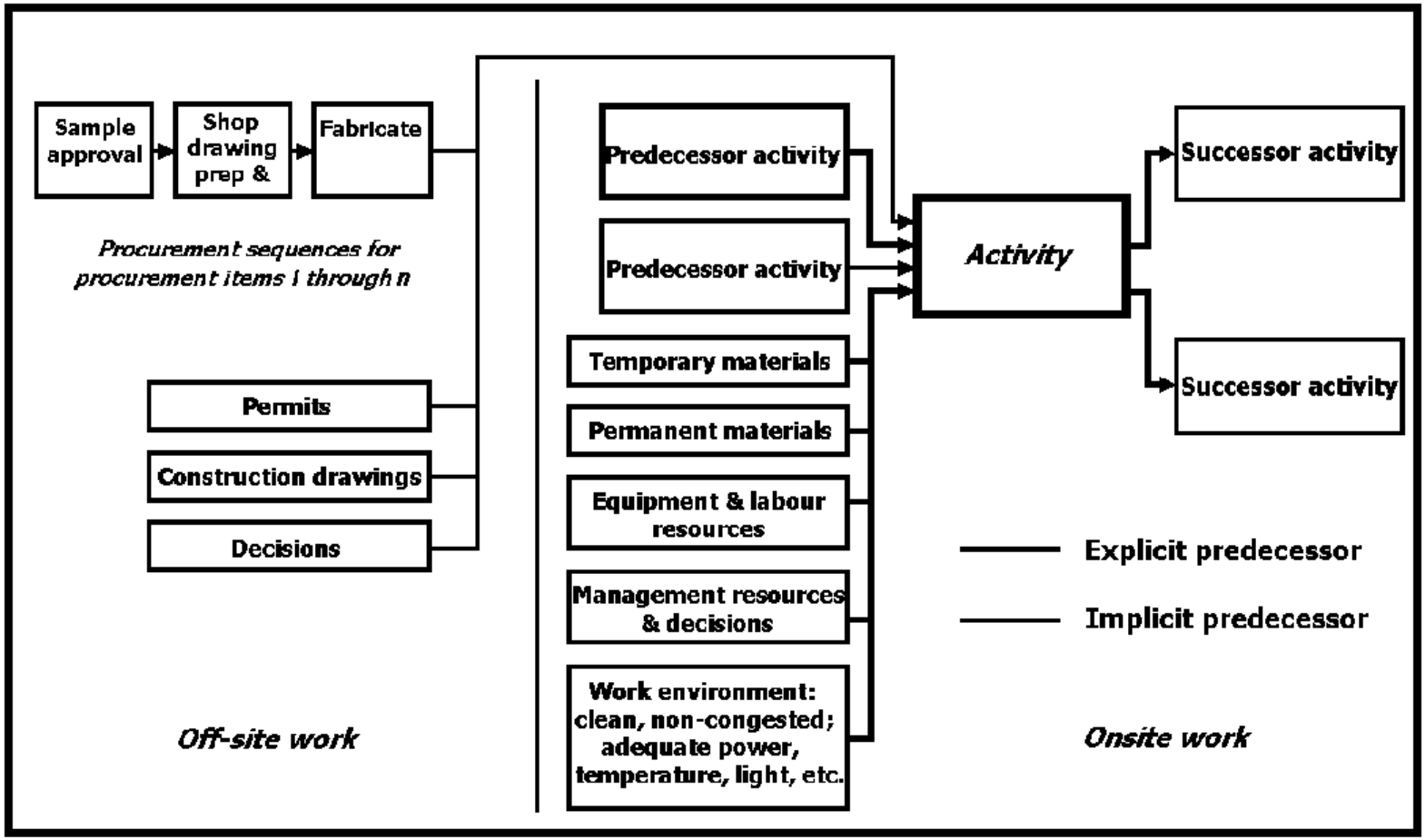
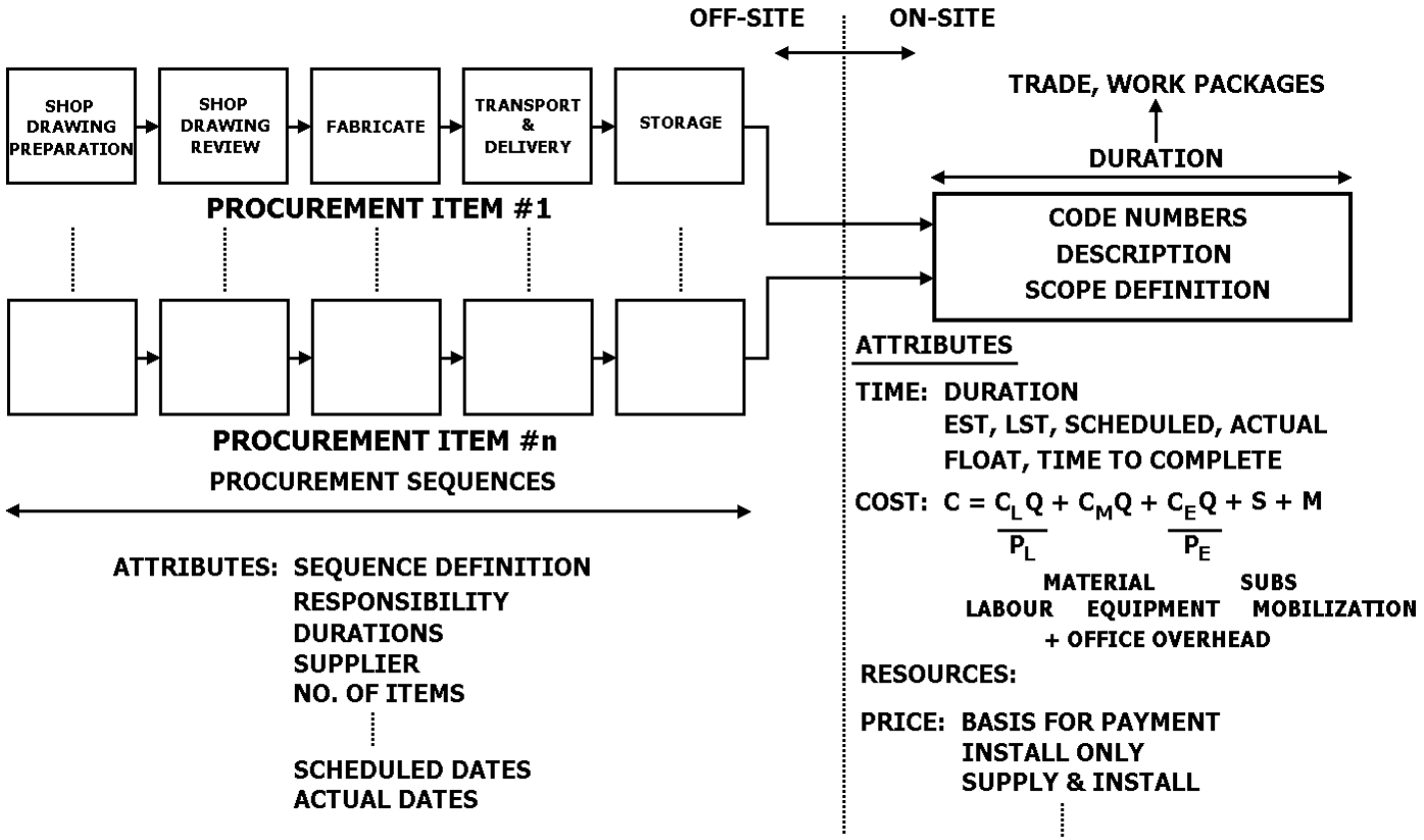


Figure 3 Implicit and Explicit Predecessors

Outputs from project plan development



THE ACTIVITY: A RESPONSIBILITY CENTRE
A TECHNOLOGY CENTRE
A COST CENTRE
A COORDINATION CENTRE
A RESOURCE CENTRE

References:

- *CIV E 601: Project Management, Lecture Notes,* Fayek, A. R. University of Alberta, 2013.
- *Project Management: Techniques in Planning and Controlling Construction Projects*, 2nd Edition, Ahuja, Dozzi, and AbouRizk, John Wiley and Sons, 1994.