

## Contents

|          |                                    |          |
|----------|------------------------------------|----------|
| <b>1</b> | <b>Project Scope Management</b>    | <b>2</b> |
| 1.1      | Introduction . . . . .             | 2        |
| 1.2      | Scope Control . . . . .            | 9        |
| 1.3      | Work Breakdown Structure . . . . . | 11       |

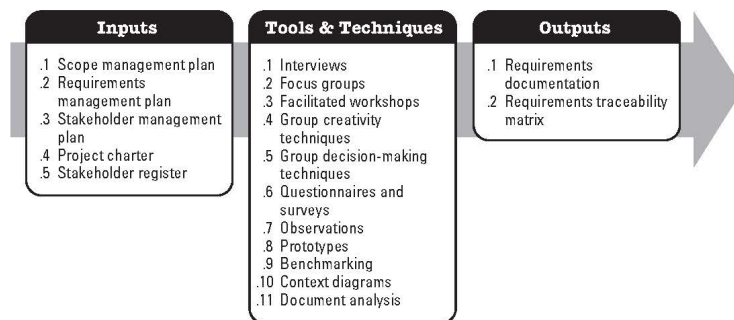


Figure 5-4. Collect Requirements: Inputs, Tools & Techniques, and Outputs

# 1 Project Scope Management

## 1.1 Introduction

### Scope Management

Primarily concerned with what is and what is not included in a project.  
Processes (not in PMBOK order)

- Collect Requirements
- Define Scope
- Verify Scope
- Control Scope
- Create WBS (Work Breakdown Structure)

### A Definition of Scope

**THE WORK THAT NEEDS TO BE ACCOMPLISHED TO DELIVER A PRODUCT, SERVICE OR RESULT WITH THE SPECIFIED FEATURES AND FUNCTIONS.**

### Collect Requirements

Part of the Planning Process Group

**Collect Requirements****Tools and Techniques**

Interviews:

- Formal or Informal to discover information from Stakeholders
- May be one-to-one or one-to-many

Focus Groups:

- Brings together pre-qualified stakeholders in order to learn about their needs wants and expectations
  - Trained Moderator leads the discussion
- 

**Collect Requirements****Tools and Techniques**

Facilitated Workshops:

- Brings Cross Functional Stakeholders together in a controlled manner
  - Build Trust, Improve communications, Increased Stakeholder consensus

Group Creativity Techniques:

- Brainstorming, Nominal Group Technique, The Delphi Method, Idea/Mind Mapping, Affinity Diagram

Refer to book for all

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**Collect Requirements****Tools and Techniques**

Group Decision Making Techniques

- Unanimity, Majority, Plurality, Dictatorship

Questionnaires and Surveys Observations

- Direct Observation (shadowing), Participant Observer

Prototypes

- Not easy in Construction, perhaps through 3D Design Visualisation Techniques
-



Figure 5-7. Define Scope: Inputs, Tools & Techniques, and Outputs

## Collect Requirements

Requirements Documentation

- Refer to Book
- Functional Requirements
- Non Functional Requirements
- Acceptance Criteria
- Support and Training Requirements

Requirements Management Plan

- How changes will be controlled

Requirements Traceability Matrix

- Links Requirements to project objectives, scope, WBS, Design, etc.

## Outputs

## Define Scope

Part of the Planning Process Group

## Define Scope

Refer to book:

- Project Charter
- Requirements Documents
- Organizational Process Assets
- Tools & Techniques
  - Expert Judgment, Product Analysis, Alternatives Identification, Facilitated Workshops

## Inputs

## **Define Scope**

Product Analysis:

- It is a method of converting product descriptions (drawings, specs, etc.) and project objectives (build times, build costs) into deliverables and requirements.
  - Included Techniques such as product breakdown, systems analysis, system engineering, value engineering, value analysis, and functional analysis
- 

## **Define Scope**

## **Stakeholder Analysis**

- Identifying Stakeholders
  - Understanding Stakeholder Roles
    - Interests, objectives, influence
  - Communicating with Stakeholders
    - Determine needs, wants, expectations
    - Separate 'key requirements' from 'wish lists'
    - Alternatives Identification
  - Technique to discover alternative methods and ways of accomplishing the project.
    - Brainstorming
    - Lateral thinking
- 

## **Define Scope**

## **Alternatives Identification**

Technique to discover alternative methods and ways of accomplishing the project.

- Brainstorming, Lateral thinking, Facilitated Workshops

Involve Stakeholders

- Make sure you understand Stakeholder's Roles
  - Interests, objectives, influence
  - As a facilitator; Determine needs, wants, expectations, Separate 'key requirements' from 'wish lists'
-

|   |                             |    |                              |
|---|-----------------------------|----|------------------------------|
| 1 | Project Objectives          | 9  | Initial Project Organisation |
| 2 | Product Scope Description   | 10 | Initial Identified Risks     |
| 3 | Project Requirements        | 11 | Schedule Milestones          |
| 4 | Project Boundaries          | 12 | Fund Limitations             |
| 5 | Project Deliverables        | 13 | Cost Estimate                |
| 6 | Product Acceptance Criteria | 14 | Config MGMT Requirements     |
| 7 | Project Constraints         | 15 | Project Specifications       |
| 8 | Project Assumptions         | 16 | Approval Requirements        |

## Scope Definition

## Output

Project Scope Statement, which includes: (refer to book for details)

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### Define Scope

Project Objectives should be SMART

- Specific
- Measurable
- Accurate
- Realistic and Tangible
- Time Bound

### Project Deliverables

- measurable outcomes, measurable results, and specific items that must be produced to consider the project (or project phase) complete.
- 

### Define Scope

Project Acceptance Criteria

- Processes (tests) and criteria for acceptance by the client.
  - i.e. WT plant, producing 10 MLD of potable water compliant with EU regs.

### Project Constraints

- Time constraints
  - Budget constraints
  - Quality constraints
  - Schedule constraints
  - Technology constraints
-

### **Project Assumptions**

*When you 'assume' you make an 'ass' out of 'u' and 'me' ☺* You can't know everything, so you will have to make assumptions. **For PM, it is vital that you record all assumptions and get the project sponsor to sign off on those assumptions**

- Typical internal assumptions would be the availability of key personnel and/or equipment for a project
  - Typical external assumptions would be that the client (sponsor) will have necessary all planning permissions.
- 

### **Scope Statement**

- Provides the basis for making future decisions in relation to scope changes
- Intended to make sure that all stakeholders have a common knowledge of what the project entails
- Addresses 7 key questions:
  - Who, What, When, Why, Where, How, How many

### **The Elephants Child - Rudyard Kipling (1902)**

I keep 6 honest serving men, (they taught me all I knew), Their names are What and Why and When, And How and Where and Who.

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### **Scope Statement v. Statement of Work (SOW)**

- Scope Statement is generated by the PM team
- Statement of Work is generated by the client
- Statement of Work is a narrative description of the end results to be provided under the contract

For construction contracts, the SOW typically provides the basis for the Scope Statement

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### **Scope Statement and SOW**

Both the client and the contractor must 'sign-off' on the Scope Statement and SOW.

- SOW is normally written into the contract and therefore signed off on.

An order of priority must also be agreed.

- i.e. SOW is typically given priority over the Scope Statement. If a discrepancy arises between the documents the SOW will be upheld.
-

## **Misinterpretation**

## **Common Causes**

- Mixing tasks, specifications, approvals, and special instructions
  - Using imprecise language
    - ‘nearly’ ‘optimum’, ‘approximately’, etc.
  - No pattern, structure or chronological order
  - Wide variation in size of tasks
  - Wide variation in how to describe details of work
  - Failing to obtain third-party review
- 

## **Misinterpretation**

## **Fixes**

In an effort to avoid pitfalls a number of private and public bodies have issued guidelines for the preparation of Scope Statements and SOWs NASA SOW Guidance Available from: [www.hq.nasa.gov/office/procurement/newreq1.htm](http://www.hq.nasa.gov/office/procurement/newreq1.htm)

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## **Advantages of Scope Statements**

- Enables client and contractor to understand the project requirements and needs.
  - Reduces claims and disputes under the contract by identifying potential issues early in the project.
  - Forces Designers, Engineers, PM team, QS team, CM team, etc. to re-examine the SOW in detail.
    - (typically post tender, and pre-contract signing)
  - Minimises RFIs and Change Orders; and the delays associated.
  - Provides a clear baseline for performance that covers the virtually every aspect of the project.
  - Clarifies acceptance tests and criteria early in the project.
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## **Validate Scope**

Part of the Monitoring & Controlling Process Group

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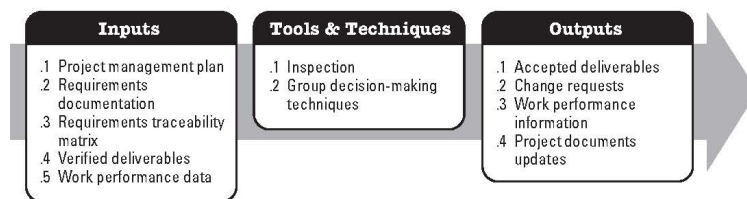


Figure 5-14. Validate Scope: Inputs, Tools & Techniques, and Outputs

## Scope Validation

- Scope Validation is carried out over the entire project duration, not just at the start
- Initial Validation involves obtaining the stakeholders formal acceptance of the project scope and associated deliverables.
  - This first Scope Statement is referred to as the '**Baseline Scope Statement**'
- Thereafter, Scope Validation is involved with checking and verifying that project deliverables and requirements are being met in accordance with the Scope Statement

## Scope Validation

Cont. ...

- Validation includes inspections to ensure that Project Deliverables are being met and accepted.
- If Project Deliverables are not being accepted, the validation process records the reasons for rejection.
- Rejection typically leads to Requested Changes, which are passed to the Integrated Change Control Process to identify potential impacts on time, cost, etc.
- Rejection can also lead to Corrective Actions (ie Rework)

## 1.2 Scope Control

### Control Scope

Part of the Monitoring and Controlling Process Group

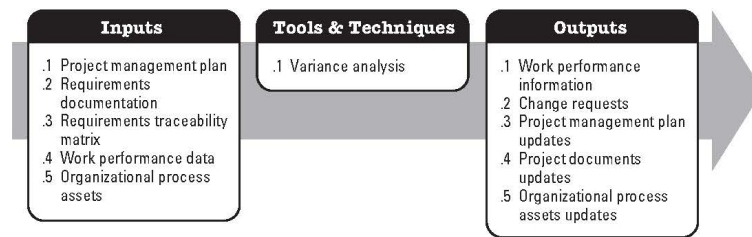


Figure 5-16. Control Scope: Inputs, Tools & Techniques, and Outputs

### Control Scope

Scope Creep... *There is no such thing as scope creep, only scope gallop* ☺ AKA 'kitchen sink syndrome' ☺

- It is a gradual process, by which additional (unauthorized) work is added to the original project
- If not properly handled, it can destroy a project and a Project Manager's reputation.

### Scope Creep

Provided it is controlled, it is not always a bad thing

- Can lead to increased profitability of a contract

Sometimes used by the unscrupulous as a means to bargain for an EOT to a contract

- Additional works anticipated to take 2 weeks
- propose to carry out the works on condition that an EOT of 3 weeks is granted.
- New DoF Contracts make this very difficult

### Control Scope

Inputs:

- Partially covered; refer to book

Outputs (refer to book for details)

- Work Performance Measurements
- Organisational Process Assets Updates
- Change Requests - Scope control does not mean always saying 'no'
- Project Management Plan Updates

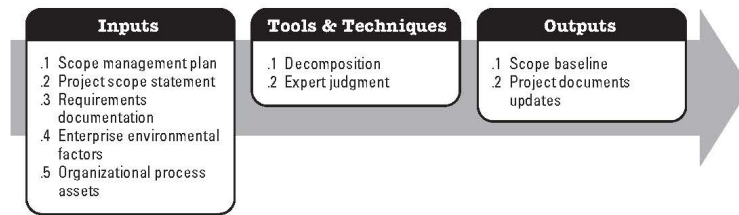


Figure 5-9. Create WBS: Inputs, Tools & Techniques, and Outputs

- Scope Baseline Update
- Other Baseline Updates (Time, Cost, etc.)
- Project Document Updates - Requirements Documents, etc.

## Control Scope

Variance Analysis:

- Determination of the magnitude of variations
- Determination of the cause of variations
  - Some variations are borne by the client; others by the contractor
- Re-planning
  - Approved change requests can effect the project scope usually require changes to the WBS, WBS dictionary, Schedules, Scope Statement, PM Plan etc.
- Change Control System
  - Impact assessment, documentation, authorization, etc.

## Tools and Techniques

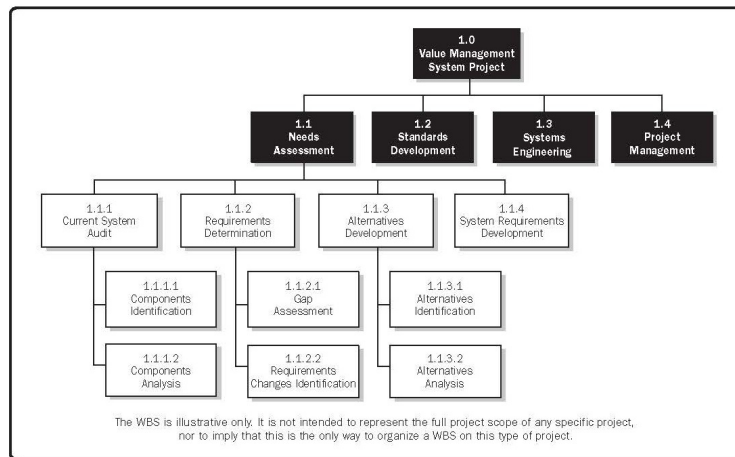
## 1.3 Work Breakdown Structure

### Create Work Breakdown Structure

Part of the Planning Process Group

### Work Breakdown Structure

*A hierarchical decomposition of the total scope of work to be carried out by the project team to accomplish project objectives and create the required deliverables.*  
 PMBOK®definition.. P567



**Figure 5-11. Sample WBS Decomposed Down Through Work Packages**

### Work Breakdown Structure

The importance of the WBS cannot be over emphasized Failure to develop a sufficiently detailed WBS will lead to:

- Scheduling issues
- Procurement issues
- Costing and Budgeting issues
- Status Reporting issues
- Unclear delegation of responsibilities
- Etc.

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### Sample WBS

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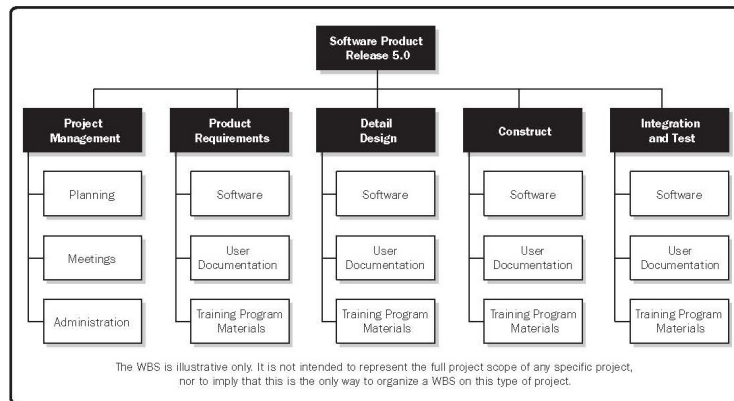


Figure 5-12. Sample WBS Organized by Phase

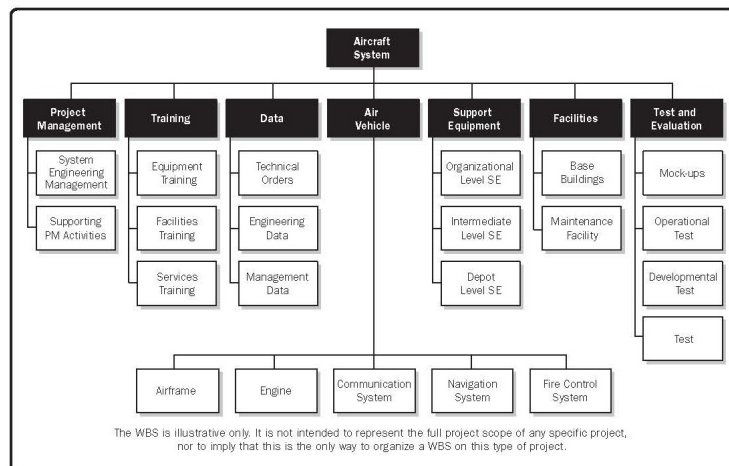
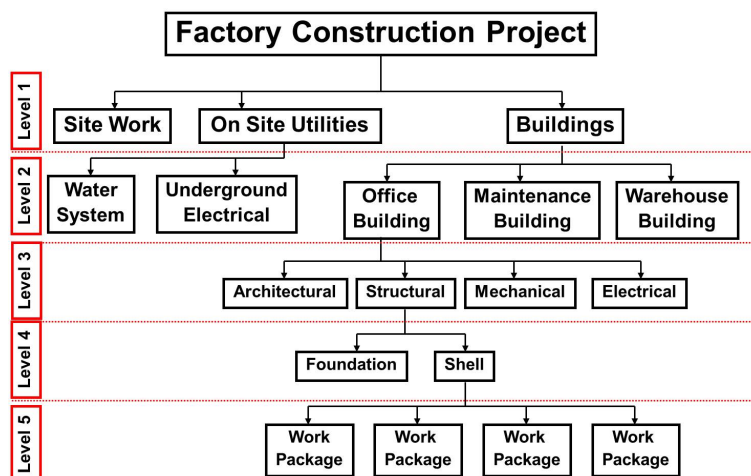
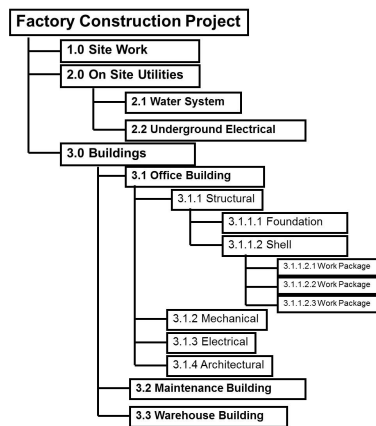


Figure 5-13. Sample WBS with Major Deliverables





|    | Task Name                     | WBS         |
|----|-------------------------------|-------------|
| 1  | Factory Construction Project  | 1           |
| 2  | Site Work                     | 1.1         |
| 4  | On Site Utilities             | 1.2         |
| 5  | Water System                  | 1.2.1       |
| 6  | Underground Electrical System | 1.2.2       |
| 7  | Buildings                     | 1.3         |
| 8  | Office Building               | 1.3.1       |
| 9  | Structural                    | 1.3.1.1     |
| 10 | Foundation                    | 1.3.1.1.1   |
| 12 | Shell                         | 1.3.1.1.2   |
| 13 | Work Package                  | 1.3.1.1.2.1 |
| 14 | Work Package                  | 1.3.1.1.2.2 |
| 15 | Work Package                  | 1.3.1.1.2.3 |
| 16 | Work Package                  | 1.3.1.1.2.4 |
| 17 | Mechanical                    | 1.3.1.2     |
| 19 | Electrical                    | 1.3.1.3     |
| 21 | Architectural                 | 1.3.1.4     |
| 23 | Maintenance Building          | 1.3.2       |
| 25 | Warehouse Building            | 1.3.3       |
| 27 | Factory Building              | 1.3.4       |

**WBS Code Definition in 'Project1'**

Code preview: 1

Project Code Prefix:

Code mask (excluding prefix):

| Level | Sequence          | Length | Separator |
|-------|-------------------|--------|-----------|
| 1     | Numbers (ordered) | Any    | .         |

☒ Generate WBS code for new task

☒ Verify uniqueness of new WBS codes

Help OK Cancel

## Sample WBS with Numbering Scheme

### MS Project

MS Project has WBS code functionality included use Project — WBS — Define Code

### WBS Levels

Dependant upon project, but in general:

- Level 1 - Total Program
- Level 2 - Project
- Level 3 - Task
- Level 4 - Subtask
- Level 5 - Work Package
- Level 6 - Level of Effort

Managerial Levels - 1 to 3 (Project Manager) Technical Levels - 4 to 6 (Line Managers)

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When the project (and work to be completed) is organised in this way it provides a framework for:

- Planning to be performed
- Costs and Budgets to be established
- Time, cost and performance to be tracked
- Schedules and Status reporting procedures to be established
- Responsibility for delivery of elements to be established and tracked
- Risk Analysis
- Development of an Organisation Structure and Responsibility Matrix

By breaking down the overall project into its constituent elements, the probability that every major and minor component will be completed is increased.

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#### **More on Levels...**

The upper 3 levels of the WBS are usually specified by the customer (SOW)

- Level 1 is generally used for authorization and release of all work
- Level 2 is generally used for budget preparation
- Level 3 is generally used for schedule preparation

The lower 3 levels are generated by the contractor for in-house control

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#### **Considerations when Generating a WBS**

1. The WBS and work description should be easy to understand
  2. All schedules should follow the WBS, not the other way around
  3. Work should not be subdivided to the lowest possible level - it is inefficient
  4. The WBS normally changes over the course of a project; build in flexibility
  5. The WBS can act as a list of milestones that can be used to assist communication project progress
  6. The WBS can be used to segregate recurring from non-recurring costs
  7. Most WBS elements range from 0.5% to 2.5% of the total project budget - 200 to 40 items
-

|   |  |                   |                    |
|---|--|-------------------|--------------------|
| <b>Work Pack</b>  | <i>Installation of Doors on 3<sup>rd</sup> Floor</i> |                   |                    |
| <b>WBS Code</b>   | <i>1.2.5.6.4</i>                                     | <b>Start Date</b> | <i>02-Feb-07</i>   |
| <b>Cost Code</b>  | <i>01.05.33.1</i>                                    | <b>End Date</b>   | <i>15-Feb-07</i>   |
| <b>Cost Est.</b>  | <i>€12,500</i>                                       | <b>Contractor</b> | <i>ABC Limited</i> |
| <b>Labour Resources</b>   |  |                   |                    |
| <i>Carpenter</i>  |  |                   |                    |
| <i>Labourer</i>   |  |                   |                    |
| <b>Equipment Resources</b>  |  |                   |                    |
| <i>None</i>   |  |                   |                    |
| <b>Description</b>  |  |                   |                    |
| <i>Hang 35 bedroom doors and 35 en-suite doors on 3<sup>rd</sup> Floor, including locks; clean area on completion</i> |  |                   |                    |

### WBS tasks and sub-tasks

WBS tasks should:

- Have clearly defined start and end dates
- Be usable as a communications tool in which results can be compared with expectations
- Be estimated on a 'total' time duration, not when a task should start and end
  - Necessary for correct scheduling and network analysis

### Work Packages

Characteristics:

- Represents the units of work at the level where the work is performed
- Clearly distinguishes one work package from all others assigned to a functional group
- Contains clearly defined start and end dates that are representative of physical accomplishment (done after scheduling)
- Specifies a budget in terms of money (€), man-hours, or other measurable units
- Limits work to be performed to relatively short periods of time.

### Minimises Work in Progress

### Example Work Package



### **WBS Dictionary**

The WBS dictionary is a companion document to the WBS. The WBS dictionary describes the WBS elements in terms of:

- Account Code identifier
  - Description of work & resources required
  - Organisation responsible
  - Milestones
  - Contractual Information
  - Quality Requirements
  - Associated schedule activities
  - Estimate of Cost
  - See Work Package Header
- 

### **WBS Checklist**

- Check the WBS for
    - Completeness
    - Anticipated effort (time & resources)
    - Compatibility
    - Continuity
  - Ensure it satisfies both functional and project requirements
  - Check that the WBS provides a logical subdivisions of project work
  - Ensure that elements can be assigned to specific individuals and/or groups
  - Check the WBS against project reporting requirements
- 

### **WBS for Sub-Contracting**

- Develop a preliminary WBS for top 3 levels
  - Ensure the Sub-contractor develops the WBS for all lower levels, and submits this information as part of their proposal and reaffirms as part of the sub-contract.
  - Ensure that the Sub-contractors WBS is compatible with project reporting requirements and the SC's own reporting and management procedures
  - In short, a Sub-Contractors WBS should be capable of full integration into the project WBS, including elements such as
    - Cost, Schedule, Resources, etc.
-

### **WBS Decomposition Problems**

- Whilst Levels 1 to 3 can be fairly standard for most construction projects, Levels 4 to 6 can be very difficult to generate
  - Breaking down work to small and detailed packages may require the creation of hundreds of cost accounts and charge numbers
  - The costs associated with producing detailed work packages may outweigh the benefits
  - The WBS forms the basis of Arrow Diagrams and Precedence Diagrams. At low levels of the WBS, the number of interconnections and dependencies over complicate the network, and can render it impossible to interpret.
- 

### **WBS Standardisation**

- Many companies who execute projects of similar nature will standardise the top 3 levels of the WBS.
  - By standardising the top levels of the WBS organisations can compare previous projects, deliverables, costing, execution etc.
  - Standardisation also lessens the time taken to develop detailed WBS
  - Standardisation aids communications, and facilitates the transfer of resources and equipment between projects.
- 

### **WBS Process Outputs**

- WBS
- WBS Dictionary
- Scope Baseline
- Project Document Updates

Typically during the generation and review of the WBS previously unidentified elements arise. These may need to be incorporated into the project, and therefore the Project Scope, and Work Breakdown Structure may require updating through the Integrated Change Control Process

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