

CHAPTER 1 – Introduction to the Work Breakdown Structure

1.1 Overview

Successful project management relies on thorough planning to define the project objectives in sufficient detail to support effective management of the project. The Work Breakdown Structure (WBS) provides the foundation for defining work as it relates to project objectives. The WBS also establishes the structure for managing the work to its completion. The remaining sections of this chapter are as follows:

1.2 – Concept

1.3 – Objectives

1.2 Concept

The WBS is used in projects:

- To define the project's scope of work in terms of deliverables and further decomposition of these deliverables into components. Depending on the decomposition method used, the WBS can also define the project's life cycle process as well as deliverables appropriate to the project, program, or any higher order entity. This project scope decomposition balances management's need for control with an appropriate level of detail.
- To provide the project management team with a framework on which to base project status and progress reports.
- To facilitate communication between the project manager and stakeholders throughout the life of the project. The WBS can be used to communicate information regarding project scope, dependencies, and risk, as well as budget and schedule progress and performance.
- As a key input to other project management processes and deliverables.

It is important to note that the WBS clearly articulates the project scope. It is a critical input to other project management processes and deliverables such as activity definitions, project schedule network diagrams, project and program schedules, performance reports, control tools or project organization. Moreover, although the WBS is a key input to these project management processes and deliverables, the WBS cannot, itself, act as a substitute for or represent any of these on its own.

For the purposes of this *Practice Standard for Work Breakdown Structures*, a project can be defined as internally focused, externally focused, or both. Additionally, deliverables for these projects can take the form of products, services, or results.

Internally focused projects can produce deliverables as inputs to other project steps, other individuals, or other organizations within the company sponsoring the project. Externally focused projects typically produce outputs and deliverables for people or organizations outside the company, such as customers or project sponsors. Many projects produce both internally and externally focused deliverables. Regardless of the focus of the project, a WBS should be prepared in all cases.

Developing a WBS is an essential step during the initial project phases; as soon as the basic scope has been identified, the initial WBS can be created with limited scope information. It will require updating, however, as additional scope information is developed or made available by more complete analysis of the project work to be performed. This updating process is known as “progressive elaboration.”

This practice standard provides insight into the WBS, its development and its application. It is expected that use of the principles found in this standard will enable the user to prepare a valuable and high-quality WBS and put it to work in the course of managing a project, program, or any higher order entity.

1.3 Objectives

The primary objectives of the *Practice Standard for Work Breakdown Structures* are to provide a common ground for understanding the concepts and benefits of the WBS, and to present a standard application of the WBS as a project management tool. The intent is to encourage consistency in applying this tool and, as a result, to improve project planning and control. The *Practice Standard for Work Breakdown Structures* is also a core project management standard that is based on the *PMBOK® Guide*—Third Edition and is used by other PMI standards.

Finally, although the *Practice Standard for Work Breakdown Structures*—Second Edition provides guidance in WBS development, it is not intended to be a tutorial on how to create a WBS.

CHAPTER 2 – Defining the WBS

2.1 Overview

A project is made more manageable by breaking it down into individual components that together are known as a Work Breakdown Structure or WBS. Such a structure defines unique work elements that can be completed independently, and facilitates other project management processes such as estimating, sequencing, resource allocation, assignment of responsibilities, and measurement and control of the project. The WBS represents a clear description of the project's deliverables, or scope—the “what” of the project. It is *not* a description of a process or schedule that defines how or when the deliverables will be produced.

This chapter will provide more information regarding WBS terms, concepts, the 100% Rule, and an example of a good WBS in action. The remaining sections of this chapter include:

- 2.2 – Common Usage of Terms
- 2.3 – Concept
- 2.4 – The 100% Rule
- 2.5 – WBS for Construction of a Bicycle
- 2.6 – Representations of the WBS
- 2.7 – Summary

2.2 Common Usage of Terms

A WBS, as defined in the *PMBOK® Guide*—Third Edition, is: “A deliverable-oriented hierarchical decomposition of the work to be executed by the project team to accomplish the project objectives and create the required deliverables. It organizes and defines the total scope of the project. Each descending level represents an increasingly detailed definition of the project work...” The following terms help clarify this definition:

Work Sustained physical or mental effort, exertion, or exercise of skill to overcome obstacles and achieve an objective. Commonly used to refer to a specific activity, duty, function, or assignment often being a part or phase of some larger undertaking; something produced or accomplished by effort, exertion, or exercise of skill. In this context, work refers to work products or deliverables that are the result of effort and not to the work activity itself.

Breakdown Division into parts or categories; separation into simpler substances; decomposition.

Structure Something arranged in a definite pattern of organization.

These definitions imply that a Work Breakdown Structure (WBS) has the following characteristics:

- Supports the definition of all work required to achieve an objective, tangible result.
- Is constructed to illustrate and define the hierarchy of deliverables. This hierarchy is organized into “parent-child” relationships.
- Has an objective or tangible result that is referred to as a deliverable. In a sense, the WBS

can be thought of as a “deliverable” breakdown structure.

Additionally, as noted above, the WBS is a deliverable-oriented hierarchical decomposition of the work to be executed by the project team. It can thus be defined in the following terms:

Deliverable	Suitable for or ready for delivery; something that can be provided as the product of development; for example, “under this contract, the deliverables include both ...”
Oriented	Aligned or positioned with respect to a point or frame of reference; focused toward the concerns and interests of a specific group.
Hierarchical	Classified according to various criteria into successive levels or layers.
Decomposition	The practice of separating the work to be executed into several simpler compounds or elements that differ from each other and define the original scope.

These definitions work together to define the overall role of the WBS, that is, to provide a foundation for the development of project schedules, communications, risk management plans, as well as other key project elements.

2.2.1 Definition of Terms

The following definitions represent WBS-related terms as defined by the *PMBOK® Guide—Third Edition*. These terms—and others listed in the Glossary of this standard—facilitate understanding of the integral role the WBS plays in project management practice. Terms are listed here in alphabetical order.

Activity A component of work performed during the course of a project.

Control Account A management control point where the integration of scope, budget, actual cost, and schedule takes place, and where the measurement of performance will occur. Control accounts are placed at selected management points (specific components at selected levels) of the Work Breakdown Structure. Each control account may include one or more work packages, but each work package may be associated with only one control account. Each control account is associated with a specific single organizational component in the Organizational Breakdown Structure (OBS). Previously called a Cost Account.

Discrete Effort Work effort that is directly identifiable to the completion of specific Work Breakdown Structure components and deliverables, and that can be directly planned and measured. Contrast with apportioned effort.

Level of Effort (LOE) Support-type activity (e.g., seller or customer liaison, project cost accounting, project management, etc.) that does not readily lend itself to measurement of discrete accomplishment. It is generally characterized by a uniform rate of work performance over the period of time determined by the activities supported.

Task A term for work whose meaning and placement within a structured plan for project work varies by the application area, industry, and brand of project management software.

WBS Component An entry in the Work Breakdown Structure that can be at any level.

Work Package A deliverable or project work component at the lowest level of each branch of the Work Breakdown Structure. The work package includes the schedule activities and schedule milestones required to complete the work package deliverable or project work component.

The following definition is included to reflect common usage:

WBS Element Any single component of a WBS, for example, a labeled box in a graphic depiction of a WBS, or a text entry in an outline.

2.3 Concept

2.3.1 Overview

The WBS assists project leaders, participants and stakeholders in the development of a clear vision of the end products or outcomes produced by the project and of the overall process by which the project will deliver those outcomes. The WBS divides the project scope into hierarchical, manageable, definable packages of work that balance the control needs of management with an appropriate and effective level of detailed project data. The WBS provides the framework for all deliverables across the project life cycle. The various levels of the WBS also provide support for focusing communication with stakeholders and aid in clearly identifying accountability to a level of detail necessary for effectively managing and controlling the project.

The upper levels of the WBS typically reflect the major deliverable work areas of the project or major phases in the project's life cycle. These levels also provide logical summary points for assessing team and individual performance, communicating accomplishments, and measuring cost and schedule performance.

The content of the upper levels can vary, depending on the type of project and the industry involved. To avoid confusion and rework, it is often prudent to define the labels for the levels of the WBS prior to its construction. The lower WBS elements provide appropriate focus for scope, schedule development, cost estimating, and resource allocation.

Whenever work is logically structured, easily identifiable, and clearly within the capabilities of individuals, project stakeholders can confidently expect that objectives associated with the work can and will be achieved. The use of a WBS helps ensure the project meets these criteria.

2.3.2 Deliverables

It is important to understand the underlying concept of a deliverable, which is the core of a WBS. The *PMBOK® Guide*—Third Edition defines a deliverable as:

Any unique and verifiable product, result, or capability to perform a service that must be produced to complete a process, phase or project. Often used more narrowly in reference to an external deliverable, which is a deliverable that is subject to approval by the project sponsor or customer.

The WBS provides the foundation for subsequently integrating the work package details and deliverables with all other aspects of project initiation, planning, execution, monitoring and control, and closing.

A deliverable-oriented WBS provides many benefits to the project, including the following:

- Better communication to project sponsors, stakeholders, and team members;
- More accurate estimation of tasks, timelines and costs;
- Increased confidence that 100% of the work is included.

The deliverable concept and deliverable orientation of the WBS are integral to understanding the proper definition and use of the WBS and the benefits it provides within the larger context of all project management processes.

2.3.3 Design

A well-designed WBS that presents information at the appropriate level of detail and in formats and structures meaningful to those performing the work is an invaluable tool in project management. It provides a graphical representation or textual outline of the project scope. Here are some roles the WBS plays in supporting clarity for project definition:

The WBS:

- Decomposes (or disassembles) the overall project scope into deliverables and supports the definition of the work effort required for effective management.
- Clearly and comprehensively defines the scope of the project in terms of deliverables that the project participants and stakeholders can understand.
- Supports documentation of the accountability and responsibility for the various deliverables by having a direct relationship among the WBS elements related to the Organizational Breakdown Structure (OBS) identified through the Responsibility Assignment Matrix (RAM).
- Provides a structure for organizing the scope and subsequent information regarding the project's progress, periodic status, and projected performance for which a project manager is responsible.
- Supports tracking of problems to their root causes to assist the project manager in identifying and implementing changes necessary to assure desired performance.

2.3.4 Management

The WBS supports effective project management in several ways during the life of a project by:

- Separating the deliverable into its component parts to ensure the project plan matches the approved project scope and will fulfill the overall objectives of the project.
- Supporting the decomposition of project scope into simpler components, providing one of the primary methods for managing complex projects.
- Providing a framework for specifying performance objectives.
- Providing a vehicle for integrating and assessing schedule and cost performance.
- Supporting the planning and assignment of responsibilities.
- Assisting in determining resource requirements such as skills and characteristics.
- Facilitating the reporting and analysis of project progress and status data, including resource allocations, cost estimates, expenditures and performance.

2.3.5 Organizational Perspective

The WBS provides the ability to relate the work defined to the responsible organizational units, subcontractors, or individuals. As the work and organizational responsibilities become more clearly defined, individuals, including subcontractors, are assigned responsibility for accomplishing specific WBS elements within defined budgets and schedules.

2.3.6 WBS Levels

The WBS includes all work to be done by the project leaders, stakeholders, and both internal and external participants, such as team members and subcontractors. The WBS provides a clear statement of the objectives and deliverables of the work to be performed. The depth of a WBS is dependent upon the size and complexity of the project and the level of detail needed to plan and manage it. Most Work Breakdown Structures consist of a multi-level hierarchy describing the entire scope to be accomplished by the primary organization; however, the specific number of levels should be appropriate for effectively managing the project in question.

2.4 The 100% Rule

The 100% Rule (Haugan, 2002) is a core characteristic of the WBS. This rule states that the WBS includes 100% of the work defined by the project scope and captures ALL deliverables—internal, external and interim—in terms of work to be completed, including project management. The 100% Rule is one of the most important elements in the development of the WBS and in the evaluation of the decomposition. The rule applies at all levels within the hierarchy: the sum of the work at the “child” level must equal 100% of the work represented by the “parent”—and the WBS should not include any work that falls outside the actual scope of the project; that is, it cannot include more than 100% of the work.

It is important to remember that the 100% rule also applies at the activity level: the work represented by the activities in each work package must add up to 100% of the work necessary to complete the work package.

2.5 WBS for Construction of a Bicycle

The following sample WBS illustrates key concepts that will be discussed throughout the remaining chapters of this standard.

Figure 2-1 is a sample WBS designed to capture the scope of work required to construct a custom bicycle. To keep the graphic simple, this particular WBS does not differentiate among the many types of bicycles that can be built from similar WBS constructs—a road bike, mountain bike, racing bike or any other—but assumes that detailed requirements for a specific type of bicycle would be provided as further decompositions of the illustrated WBS elements.

This particular example was selected for its simplicity—to enable the reader to focus on the WBS itself, rather than the multitude of alternatives, options, and components required to define a complex, unique, and perhaps esoteric product. The bicycle is a familiar and common product, an example that easily suggests the processes required to produce the end result.

This illustration shows how concepts and guidance described in later chapters work together to produce a “high-quality” WBS that can be used as a foundation for a project that will deliver the desired end product—a completed bicycle that meets the quality, timeliness, feature and functionality requirements of the purchaser.

Specifically, this WBS illustrates the various levels of a WBS, the numbering scheme, naming convention, relationship of parent and child WBS elements, and the representation of each of these characteristics and elements working together to form a complete WBS.

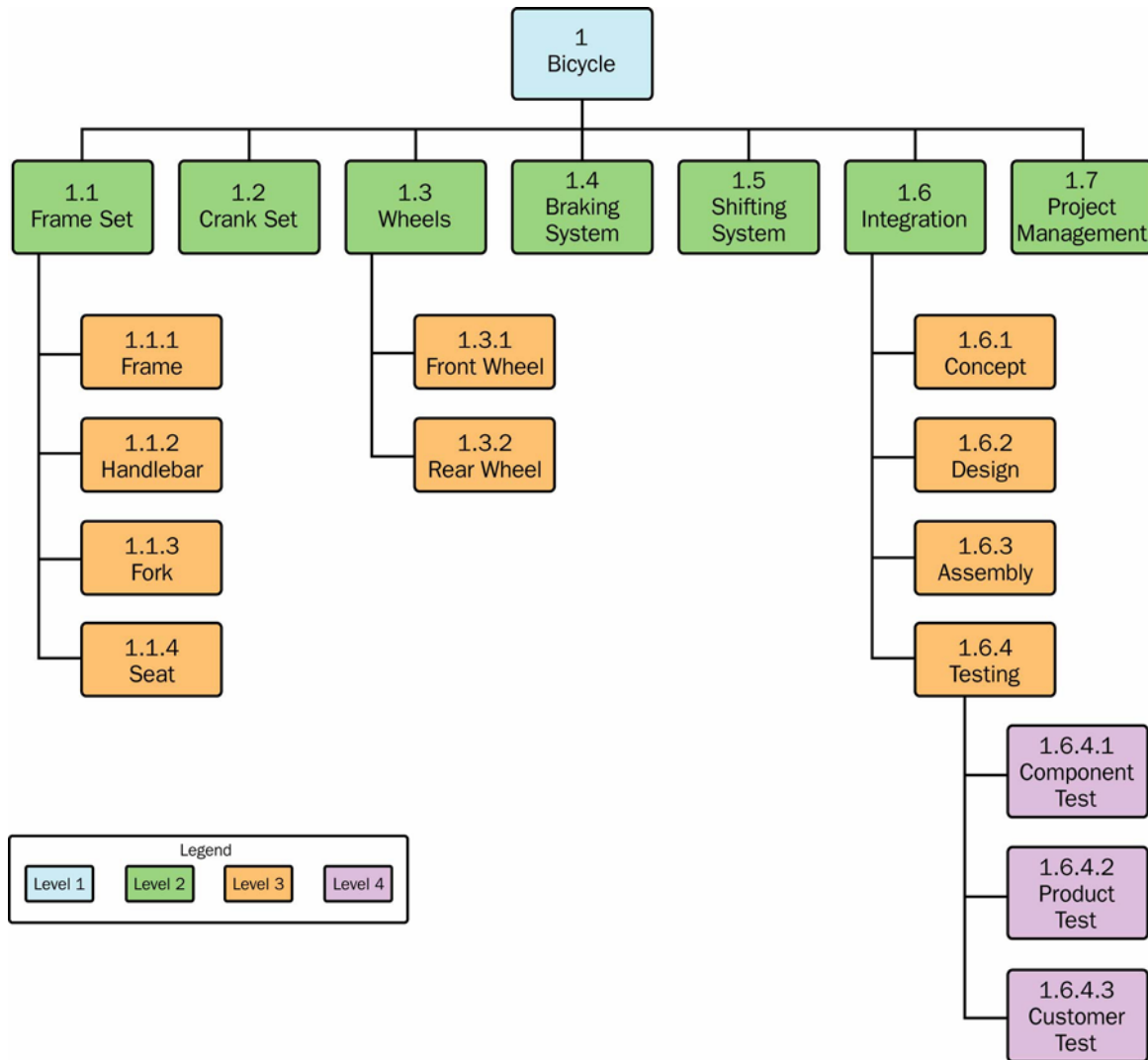


Figure 2-1. WBS Bicycle Example

The bicycle WBS helps to communicate and reinforce some of the concepts presented. The annotated illustration (Figure 2-2) immediately following shows that all WBS elements are not decomposed to the same extent. For example, this hypothetical bicycle WBS does not decompose each level 2 WBS component further into sub-elements. While it can be helpful to decompose the entire WBS to the same level for some projects, there are no hard and fast rules dictating that each WBS element be decomposed to the same level. Decomposition is a use-related characteristic that is defined by the context of the project the WBS is developed to support. This concept is presented in detail in Chapter 4, Section 4.2.

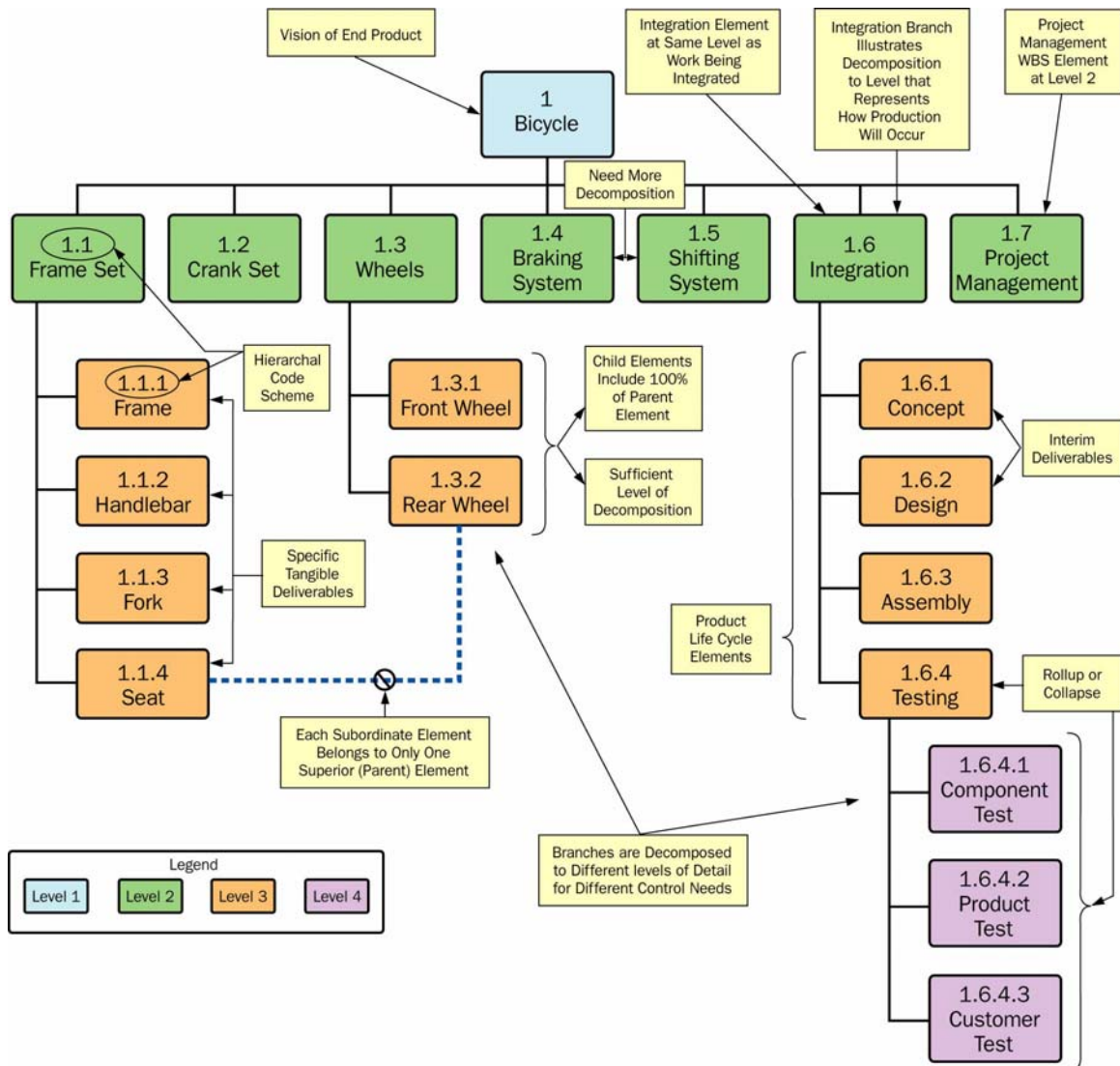


Figure 2-2. Annotated Bicycle Example

Additionally, this example communicates WBS concepts that reflect application in a broad array of industries. The construction of the WBS can remain the same, such as the relationship of the elements, the decomposition level, and the relationship to other WBS elements. The content of the elements can be modified to reflect the application of the concept in other terms for other industries. This is illustrated in the decomposed elements that lie beneath the Level 2 WBS element for “Integration” (WBS element 1.6). In the drawing above, elements 1.6.4.1–1.6.4.3 are called “Component Test,” “Product Test” and “Customer Test,” respectively. In the next example, Figure 2-3, these same elements are entitled “Unit Test,” “System Test” and “Acceptance Test,” showing how the concept of testing is represented in similar fashion using basic WBS elements.

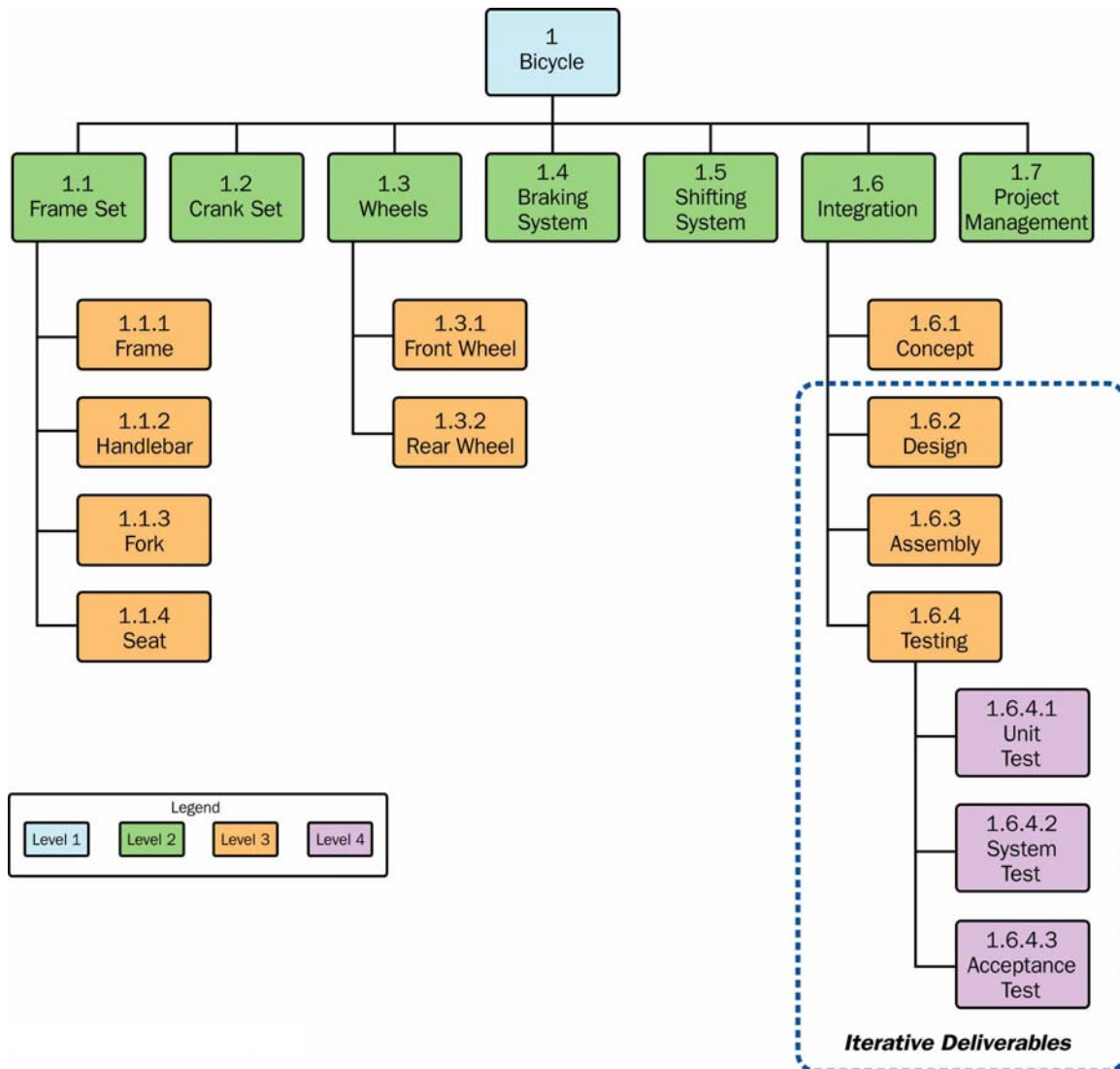


Figure 2-3. WBS Example

Finally, throughout the standard, the bicycle WBS is repeatedly used as a reference point to clarify and illustrate concepts. To illuminate the concept being discussed, parts of the WBS are extracted, elements are singled out, or sets of decomposed elements are highlighted by placing dotted lines around them. For clarity, these WBS elements are frequently shown in a number of different representations.

2.6 Representations of the WBS

The WBS can be represented in a variety of ways including graphical, outline, and textual view, all of which are valid. Regardless of the method used, these approaches enable a project team to predict and forecast task costs, schedules, resource requirements and allocations more accurately. Two common methods are the hierarchy diagram and the outline or tabular view.

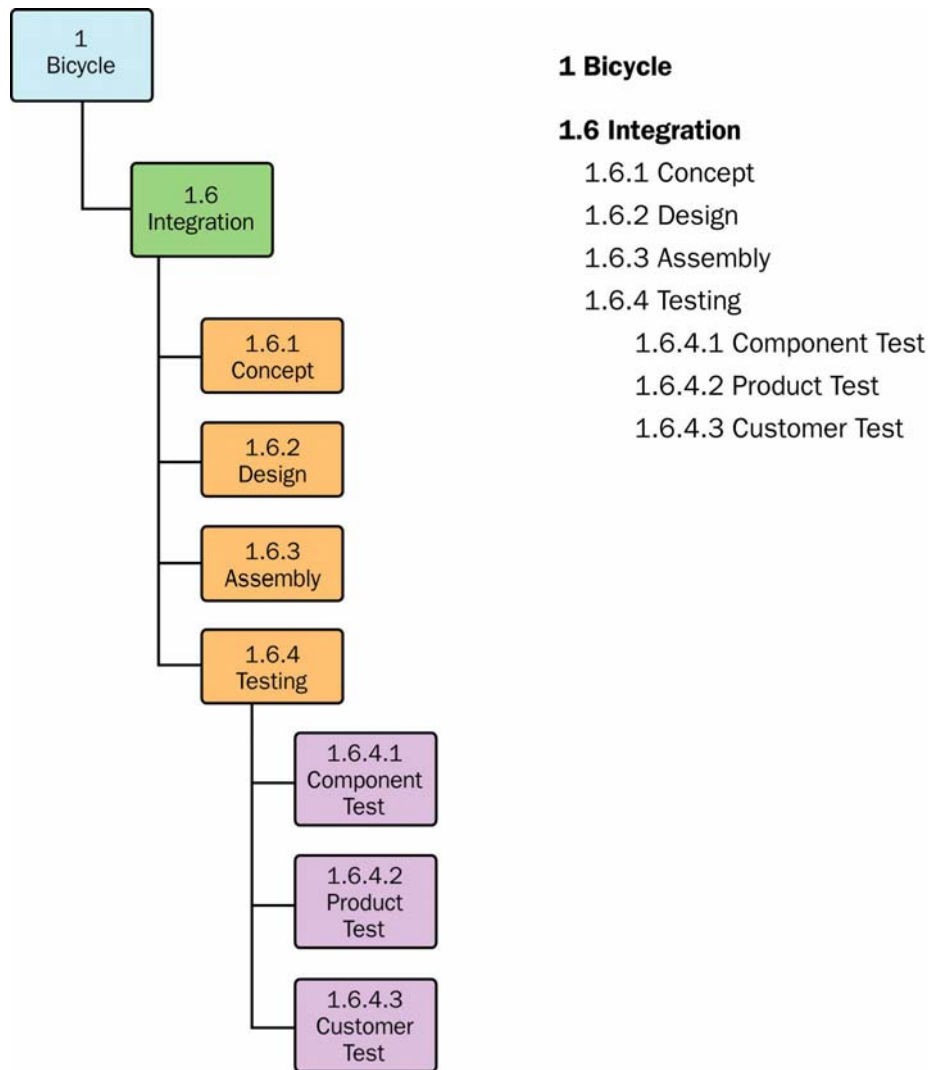


Figure 2-4. WBS Representations Comparison

2.7 Summary

In summary, the WBS:

- Defines the hierarchy of deliverables.
- Supports the definition of all work required to achieve an end objective or deliverable(s).
- Provides a graphical representation or textual outline of the project scope.
- Provides the framework for all deliverables across the project life cycle.
- Provides a vehicle for integrating and assessing schedule and cost performance.
- Facilitates assignment of resources.
- Facilitates the reporting and analysis of progress and status data.
- Provides a framework for specifying performance objectives.

CHAPTER 3 – The Importance of the WBS

3.1 Overview

Can a project be a success without a WBS? Consider the following. The WBS:

- Defines all the work of the project, and only the work of the project, thereby clarifying the project scope.
- Should be developed by all key project team members to achieve buy-in.
- Provides the baseline for subsequent change control.
- Is a primary input to other project management processes—for example, resource planning, cost estimating, schedule development, and risk identification.
- Provides the framework for project control, performance monitoring, and the foundation for communication with all stakeholders.
- Ensures the work of the project correlates appropriately with the Responsibility Assignment Matrix (RAM) and the Organizational Breakdown Structure (OBS).
- Is referenced in other PMI standards—for example, the *PMBOK® Guide*—Third Edition and *Practice Standard for Earned Value Management (EVM)*—as an essential planning deliverable supporting key project management functions.

Challenged and failed projects may be devastating to an organization. Experienced project managers know that there are many things that can go wrong in projects regardless of how successful project managers are in the planning and execution of their work. Project failures, however, can often be traced back to a poorly developed or nonexistent WBS.

A poorly constructed WBS can result, among other things, in the following project stumbling blocks and adverse project outcomes:

- Incomplete project definition leading to ongoing project extensions
- Unclear work assignments, goals, objectives, or deliverables
- Scope creep or unmanageable, frequently changing scope
- Budget overrun
- Missed deadlines on scheduled deliverables, or timeline slippage
- Unusable new product or feature
- Failure to deliver on some elements of project scope.

The remainder of this chapter highlights in more detail the important role the WBS plays in project and program management planning:

- 3.2 – Integration with PM Processes
- 3.3 – Relationship to Other Tools
- 3.4 – WBS Integration and Use by Other Standards
- 3.5 – Summary

3.2 Integration With PM Processes

The WBS is created in the Create WBS planning process. The WBS also plays an integral role in other PM processes. Examples are shown in the following table:

Process Group	Importance of WBS in Process
Initiating	<ul style="list-style-type: none"> • Develop Preliminary Project Scope Statement <ul style="list-style-type: none"> ◦ Historical WBS elements can contribute in determining the scope and viability of projects.
Planning	<ul style="list-style-type: none"> • Scope Planning <ul style="list-style-type: none"> ◦ The Scope Planning process documents how the WBS will be created and defined. • Scope Definition <ul style="list-style-type: none"> ◦ The WBS further defines the entire scope of the project. • Activity Definition <ul style="list-style-type: none"> ◦ The WBS is an input source to this process, and is a key component of a Project Plan. • Human Resource Planning <ul style="list-style-type: none"> ◦ The WBS is an input source to this process, and is a key component of a Project Plan. • Cost Estimating <ul style="list-style-type: none"> ◦ The WBS is an input to this process. • Cost Budgeting <ul style="list-style-type: none"> ◦ The WBS is an input to this process. The WBS identifies project deliverables to which costs will be allocated. • Risk Identification <ul style="list-style-type: none"> ◦ The WBS identifies project deliverables that must be evaluated for risk events. • Risk Response Planning <ul style="list-style-type: none"> ◦ The WBS might be updated to include work and deliverables required for risk management. • Plan Purchases and Acquisitions <ul style="list-style-type: none"> ◦ The WBS is an input to this process.
Executing	<ul style="list-style-type: none"> • Information Distribution <ul style="list-style-type: none"> ◦ The WBS provides the basis for developing the communications plan and the level of granularity at which project information can be distributed. The WBS helps determine what level of project detail is appropriate to communicate to different stakeholder groups.
Controlling	<ul style="list-style-type: none"> • Scope Control <ul style="list-style-type: none"> ◦ The WBS is an input source to this process, which is a key component of a Project Plan. It is important to adjust the WBS if project scope is changed so that future changes will be based on an updated, agreed-upon project baseline. A WBS enhances the project manager's ability to assess the impact of scope changes. • Cost Control <ul style="list-style-type: none"> ◦ The creation of the WBS reveals the best point in the hierarchy of deliverables at which to implement cost control.

Table 3-1. Project Management (PM) processes

3.3 Relationship to Other Tools

3.3.1 Project Management Tools

The purpose of the WBS, as a project management tool, is to organize the scope of a project. Higher order scope definition practice such as the program management process can use similar techniques to organize scope. There are many project management tools that use the WBS or its components as input.

Project Charter: The WBS takes the project charter as its starting point. The highest-level element in the WBS should represent the project's overall end-point product(s), service(s), or outcomes as described in the Project Charter. If the project's major products cannot be described during the creation of the WBS, then the project management team should examine the charter to determine if it has been sufficiently defined.

Project Scope Statement: The Scope Statement for the project is intended to clearly and succinctly describe what the project is and is not intended to accomplish. The high-level elements in the WBS should match, word-for-word, the nouns used to describe the outcomes of the project in the Scope Statement. If the project management team has difficulty identifying the objects in the Scope Statement and applying them to the high-level WBS elements, the team should carefully examine the Scope Statement to determine if it sufficiently captures all project outcomes and deliverables.

Program and Higher Order WBS: The WBS can be used to show relationships with higher order scope management constructs. For example, program offices are typically established to share tools, techniques, methodologies, and resources in managing one or more collections of related projects as program(s). The project WBS must illustrate a clear understanding of the relationship among highly decomposed work packages within individual projects and program (or higher order) scope definitions. If strategic changes are made, the impact on projects, resources, and budgets can be easily calculated, assuming the project WBS has been constructed correctly in consideration of these higher order factors.

RBS: The Resource Breakdown Structure (RBS) describes the project's resource organization and can be used in conjunction with the WBS to define work package assignments. The link between work packages and the RBS can be used to verify that all members of the project team have been appropriately assigned work packages, and that all work packages have owners.

OBS: The Organizational Breakdown Structure (OBS) is loosely related to the WBS. The OBS depicts the organization hierarchy, allowing the project's work packages to be related to the performing organizational units. This tool reinforces the guideline that each work package should have a single point of responsibility. The OBS can be a useful tool for project managers in that it clearly demonstrates what a WBS does not; namely, the OBS is organized by people or groups, whereas the WBS is strictly organized by deliverables.

WBS Dictionary: The WBS Dictionary is a key document that accompanies the WBS and carries critical project information. The WBS Dictionary defines, details, and clarifies the

various elements of the WBS to ensure that each component of the WBS is accurately articulated and can be communicated to anyone referencing the WBS. The development of the WBS Dictionary often uncovers ambiguity or other errors in the WBS itself, and results in revisions to the WBS. The WBS Dictionary contains information about each element of the WBS, including a detailed description of the work, deliverables, activities, and milestones associated with each element. The WBS Dictionary might also include an indication of the type and number of resources required and contract control information, such as a charge number or other similar data. Often, a WBS Dictionary will include traceability matrices linking the WBS to other scope control documents such as statements of work or requirements documents.

Project Schedule Network Diagram: The Network Diagram is a sequential arrangement of the work defined by the WBS, and is essential to uncovering project dependencies and risks. The lowest-level elements of the WBS are arranged to show precedence and order. Developing the network diagram often uncovers problems in the WBS—such as incomplete decomposition, the assignment of too much work in an element, or more than one person responsible for an individual WBS element—thus resulting in needed revisions.

Project Schedule: The various elements of the WBS are used as starting points for defining the activities included in the Project Schedule. Implied dependencies can be recorded in the WBS Dictionary, and the activities as described in the WBS Dictionary are then included as detail in the schedule.

Because of interrelationships among the WBS and other project management tools, it is important to note that any change in the WBS requires an associated change in the related tools.

This discussion briefly describes how many project management tools are interrelated, all based upon the foundation of the WBS. The Work Breakdown Structure plays an integral role in project and program management, from the Initiating and Planning phases through Monitoring/Controlling and Executing.

Such interrelationships among the WBS and other Project Management processes are described throughout the *PMBOK® Guide*—Third Edition. As an example of these interdependencies, consider the relationship between the WBS and the activity list used for the project schedule as described in Section 6.1.2 of the *PMBOK® Guide* (Activity Definition: Tools and Techniques). Specifically, item 6.1.2.1 (Decomposition) reads:

“The technique of decomposition, as it is applied to activity definition, involves subdividing the project work packages into smaller, more manageable components called schedule activities. The Activity Definition process defines the final outputs as schedule activities rather than as deliverables, as is done in the Create WBS process (Section 5.3).”

“The activity list, WBS, and WBS dictionary can be developed either sequentially or concurrently, with the WBS and WBS dictionary being the basis for development of the final activity list. Each work package within the WBS is decomposed into the schedule activities required to produce

the work package deliverables. This activity definition is often performed by the project team members responsible for the work package.”

Section 6.2 of the *PMBOK® Guide* (Activity Sequencing) further states:

“Activity sequencing involves identifying and documenting the logical precedence relationships among schedule activities. Schedule activities can be logically sequenced with proper precedence relationships, as well as leads and lags to support later development of a realistic and achievable schedule.”

3.3.2 WBS Development Tools

There are a number of project management tools that can be used to assist a project manager with the development of a WBS. These tools include outlines and organization charts, fishbone and brainstorming techniques, and top down and bottom up development strategies. There are many WBS templates available, and corporate standards can be referenced or copied for quick-starting WBS development. (More information about these tools can be found in Chapter 5 of this *WBS Practice Standard*.)

There are many benefits to using tools to develop a WBS. For example, tools often promote consistency and repeatability in the development of a WBS, especially enterprise productivity tools. WBS tools can also promote and enforce the principles of the WBS standard and can significantly reduce the development effort, simplifying the WBS process, and even promoting reusable WBS products.

3.4 WBS Integration and Use by Other Standards

Similar to the *WBS Practice Standard*, there are other project and program management standards to which the issue of project scope is central and integral. PMI standards where scope is important include, but are not limited to: the *PMBOK® Guide*—Third Edition; *Practice Standard for Scheduling*, *Practice Standard for Earned Value Management (EVM)*, and *Organizational Project Management Maturity Model (OPM3®)*. Therefore, the successful application of these standards depends, in part, on the effective application of this *WBS Practice Standard*. Moreover, the development of a quality WBS is critical to successful execution of project management processes, as described in the *PMBOK® Guide*—Third Edition, as well as in the other aforementioned standards.

Standards that take advantage of the WBS typically fall into one of two categories. The first category focuses on using the content output of the WBS as an input. PMI’s Scheduling and Earned Value Management (EVM) practice standards fall into this category. Since the content output from a WBS is predictable and well understood, such standards can build upon or leverage the *WBS Practice Standard*.

Other standards incorporate the WBS (as defined by this practice standard) as the preferred technique to develop the scope definition for their role. For example, the *PMBOK® Guide*—Third Edition uses the *WBS Practice Standard* to develop the project scope, and OPM3 identifies

the WBS as a tool that can be used to develop a program WBS. These standards recognize the *WBS Practice Standard* as representing best-in-class practice, and make good use of it, rather than building a competing scope management standard.

Scheduling: The WBS is developed to define carefully what is in the project scope and, by implication, what is out of scope. *The Practice Standard for Scheduling* is based, in part, on an assumption that a high-quality WBS has been developed using good practice, correctly defining project scope. When the project schedule is developed, each high level (summary) task must correspond to a WBS element. If an activity or task does not have a relationship to a work package within the WBS, then either the WBS does not fully encompass the project scope, or the activity or task is unnecessary.

EVM: EVM is a management methodology for integrating scope, schedule, and resources, and for objectively measuring project performance and progress. The data used in EVM are dependent upon WBS elements having been developed using good practice. If WBS elements are not well defined, are too large in scope, are too lengthy in duration, or are in some other manner not appropriately decomposed or developed, it will be difficult to measure the project's Earned Value. The *Practice Standard for Earned Value Management* relies upon a high-quality WBS as a key input.

PMBOK® Guide: The *PMBOK® Guide*—Third Edition, PMI's renowned project management standard, discusses all elements of project management practice. A core element of project management is scope management, and the *PMBOK® Guide* discusses the benefits of using the WBS as a technique to manage and control a project's scope.

Program Management: *The Standard for Program Management* describes how collections of related projects are best managed. This standard assumes that the WBS for each relevant project is developed according to good practice and accurately describes the scope for the project.

Portfolio Management: *The Standard for Portfolio Management* describes how collections of projects or programs are best managed. This standard assumes that the WBS for each relevant project/program is developed according to good practice and accurately describes the scope for the project.

OPM3: PMI's OPM3 is an example of a maturity model that can be used to measure and detail an organization's maturity level, as well as provide a clear path to higher levels of maturity. The WBS is important to OPM3, since OPM3 relies on the benefits of processes aimed at scope management. This standard relies on the development of a quality WBS as a foundation for effective project management.

3.5 Summary

The WBS is a critical element in the planning and execution of a successful project. Many project cost, schedule, and quality failures can be traced directly to flaws in the development of the project's WBS. It is highly unlikely that a project will be successful without the existence of a quality WBS. In contrast, developing and applying a quality WBS will significantly increase

the likelihood of successful project completion. The next chapter will provide insight into the characteristics and components that make up a high-quality WBS.

Chapter 4 – Defining WBS Quality

4.1 Overview

What does it mean to create a quality WBS and how can a quality WBS be recognized once it is created? The *PMBOK® Guide*—Third Edition considers quality to involve the “the degree to which a set of inherent characteristics fulfills requirements.” This includes the ideas of conformance to requirements and fitness for use; that is, the ability to satisfy the purpose for which the item—in this case a WBS—was intended. (See Chapter 3 of this *WBS Practice Standard* for the uses, purpose and importance of the WBS.) To state that a particular WBS is of “high quality,” one must agree that the WBS has been created so that it satisfies the purpose for which it was created.

There are two basic principles that govern the quality of a WBS. This chapter will describe these principles and identify the characteristics of a high-quality WBS that flow from each principle. It will illustrate the negative effects of a poorly constructed WBS and it will provide tools for project managers to use in evaluating any specific WBS that is being developed. The remaining sections of this chapter are as follows:

- 4.2 – WBS Quality Principle #1
- 4.3 – WBS Quality Principle #2
- 4.4 – Annotated Example of a High-Quality WBS
- 4.5 – Problem Diagnostic Checklist
- 4.6 – Summary

4.2 WBS Quality Principle #1

A “quality WBS” is a WBS constructed in such a way that it satisfies all of the requirements for its use in a project.

There are two sub-principles that pertain to satisfying requirements for use of a WBS. These describe core characteristics of every WBS and use-related characteristics that describe a particular WBS based on its individual setting and use.

4.2.1 WBS Quality Principle #1 – Core Characteristics:

There is a set of “Core Characteristics” that must be present in every WBS, as these characteristics enable the WBS to satisfy project needs that are present in every project.

With respect to “Core Characteristics” a WBS either has them or it does not, and, as such, these characteristics represent the minimum set of specific attributes a WBS must contain. When evaluating or developing a WBS, the absence or presence of these core characteristics will dictate whether or not it is a “Quality WBS.” A WBS with the following core quality characteristics can be said to have “Core Quality”:

“Core Characteristics” of a Quality WBS

- The WBS defines the scope of the project.
- It clarifies the work and communicates project scope to all stakeholders.

- The WBS contains 100% of the work defined by the scope or contract.
- It captures internal, external and interim deliverables in terms of work to be completed, including project management.
- It is constructed so that each level of decomposition contains 100% of the work in the parent level.
- The WBS can be expressed as a chart or outline.
- It provides a graphical or textual breakdown of the project scope.
- The WBS is a deliverable-oriented grouping of project elements.
- Its elements are defined using nouns and adjectives – not verbs.
- The WBS arranges all major and minor deliverables in a hierarchical structure.
- It employs a coding scheme for each element that clearly identifies its hierarchical nature when viewed in any format such as a chart or outline.
- It has at least 2 levels with at least one level of decomposition.
- The WBS is created by those who will be performing the work.
- It is constructed with technical input from knowledgeable subject matter experts (SMEs) and other project stakeholders, such as financial and business managers.
- The WBS iteratively evolves along with the progressive elaboration of project scope, up to the point of scope baseline.
- After the project scope has been baselined, the WBS is updated in accordance with project change control, thereby allowing for continual improvement.

4.2.2 WBS Quality Principle #1 – Use-related Characteristics:

There is an additional set of “Use-related Characteristics” that may vary from one WBS to another. These characteristics enable the WBS to be used for purposes that are unique to a specific project, industry or environment, or are applied in a particular way to individual projects.

With respect to “Use-related Characteristics,” the quality of a WBS depends on how well the specific content and type of WBS elements meet all the needs for which the WBS has been developed. This statement implies that the more project needs are met by the WBS, the higher its quality; in other words, the better a WBS addresses project needs, the higher its quality. A high-quality WBS is constructed so that it can be used to meet all project requirements—even if it is not actually used for all of them.

“Use-related characteristics” support the application of WBS practice in situational contexts. These can include, and are not limited to the following:

- **Achieves a sufficient level of decomposition:** A WBS is broken down to a level of detail sufficient for managing the work. The appropriate level of detail to enable effective management can differ from organization to organization or project to project.
 - The depth of the WBS correlates with the size and complexity of the project and the level of detail needed to plan and manage it.
 - All deliverables are limited in size and definition for effective control. However, they should neither be so small that the cost of control is excessive, nor should they be so large that the item is unmanageable or the associated risks cannot be identified. The

cost of control should not be greater than the value of the work being managed.

- **Provides sufficient detail for communicating all work:** A WBS facilitates conceptualization and definition of the product, service, or result (deliverable) details. But the degree of WBS detail necessary for conceptualization of project detail can vary. For example, existing modules can be satisfactorily described by a product number, while to-be-designed components might need to be described in greater detail. To ensure clarity of communication regarding the intent of any WBS element, an entry detailing specific information about the WBS element should be placed in the WBS Dictionary. This will minimize misunderstanding of the WBS and, in turn, the project scope.
- **Is appropriate for tracking, as required by the specific project or organization:** Some projects or organizations can require highly detailed performance reporting at the work package level, while others might require only summary level reporting at a WBS rollup level.
 - The WBS has logical summary points that assist in tracking for evaluating performance accomplishments, resource allocations, costs, and schedule performance.
 - Suitable management control points are identified in the WBS that can be used to facilitate communication and to control scope, quality, and technical soundness.
 - In summary, the WBS provides a feasible mechanism to assess performance and progress.
- **Is appropriate for control activities:** A WBS balances the control needs of management with an effective level of project detail. It provides a good balance between complexity, risk, and the project manager's need for control.
 - A large, complex project can require many intermediate reviews at the work package level, while a shorter, less complex project might require only a few performance assessments at a higher WBS level.
 - Elements are detailed enough to meet performance measurements and accountability objectives, thereby facilitating effective planning, monitoring, and control.
- **Can contain specific kinds of WBS elements, as needed for each project:** Some projects might need to include a majority of the following types of WBS elements, while other projects need only one or two:
 - Some project WBSs can include elements for process management, integration, services and provisioning (procurement and supply chain management), information/communication, administration documentation, training, and software development.
 - WBS elements representing subcontracted or externally committed deliverables should directly correspond to matching elements in the subcontractor's WBS.
 - A WBS might include level-of-effort WBS elements.
 - Deliverables from the development life cycle stages, such as planning, analysis, design, assembly, testing, and implementation, can be reflected in the WBS, where appropriate.
 - WBS elements can reflect the deliverables within the product development life cycle, where appropriate, such as in the IT industry.
- **Enables assignment of accountability at the appropriate level:** Some projects or organizations can require assignment of accountability at a very detailed, work package level, while others might be satisfied with accountability assigned at a summary rollup level.

- Each WBS element can be assigned to an accountable individual, subcontractor, or organizational unit.
- The WBS can serve as the mechanism for documenting the accountability and responsibility for the various deliverables by having a direct relationship among the WBS elements related to the Organizational Breakdown Structure (OBS) identified through the Responsibility Assignment Matrix (RAM).
- WBS elements clearly identify accountability to the level of detail required for managing and controlling the project.
- **Has a succinct, clear, and logically organized structure to meet project management and oversight requirements:** The logic of the hierarchical decomposition of a project can vary in response to a variety of project and organizational factors.
 - The WBS decomposition level balances the project definition with data collecting and reporting requirements.
 - WBS elements are compatible with relevant organizational and accounting structures.

4.3 WBS Quality Principle #2

A WBS is a WBS.

There is essentially no difference between a project WBS, a program WBS, and any other higher order WBS. A high-quality WBS developed at any of these broader levels possesses precisely the same characteristics and attributes as a high-quality WBS developed at the individual project level. These differ only in the breadth of the content and scope.

4.4 Annotated Example of a High-Quality WBS

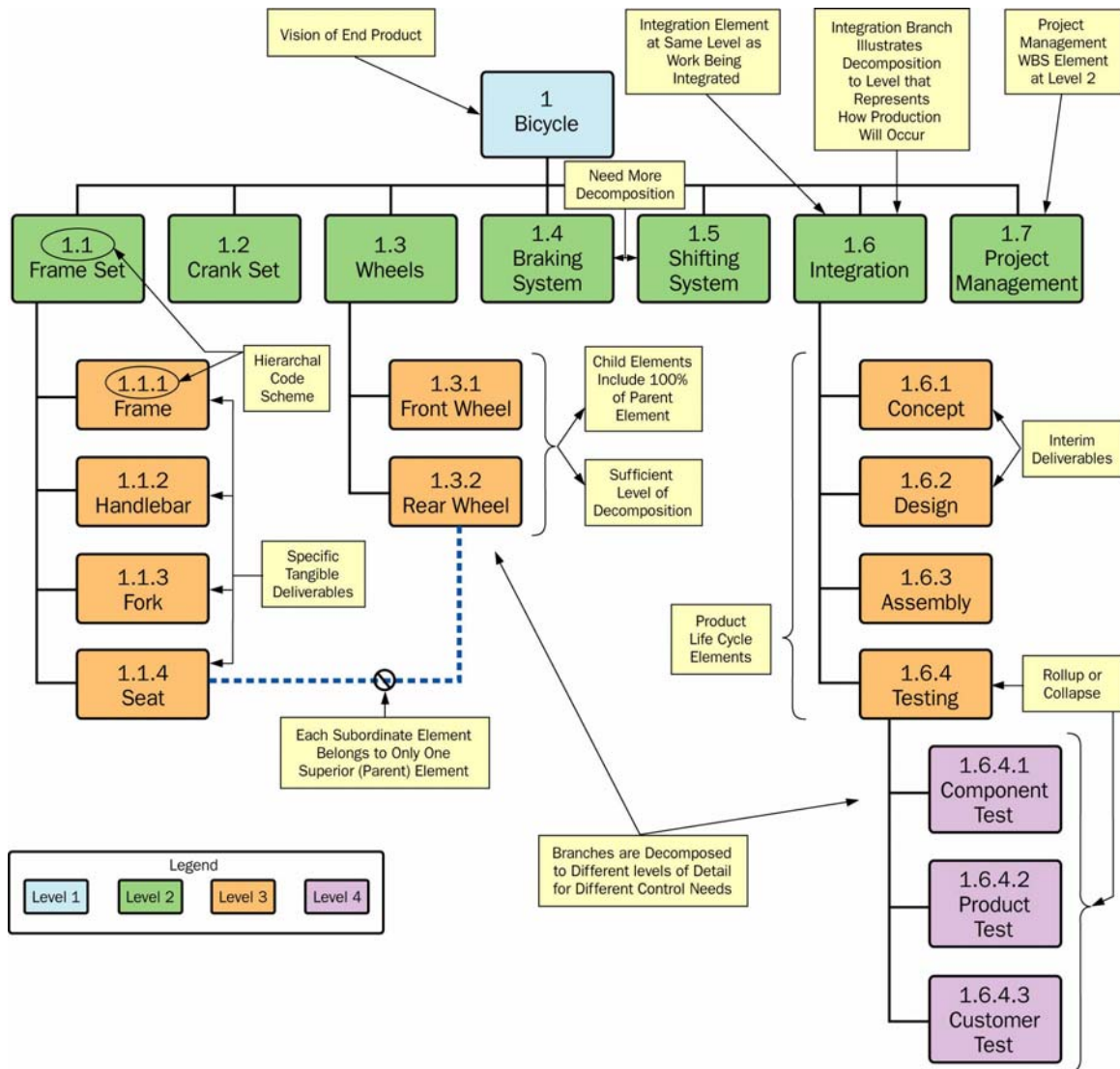


Figure 4-1. Annotated Example of a High-Quality WBS

This WBS example is based on a hypothetical company that builds bicycles to an individual customer's specifications. The annotations refer to specific characteristics of a high-quality WBS. The above diagram illustrates a simplified WBS as it pertains to a sample project. The project is the design and building of a bicycle. As the diagram above represents, this is an example of a WBS to encompass the work for this sample project.

Level 1 – This level comprises the full scope of work necessary to produce the bicycle. It includes all direct and indirect work. Level 1 is the overall product, always a single WBS element.

Level 2 – This is the first level of decomposition. This level is the high-level breakdown of the major areas in the scope of work. It holds the basic components of the product, along with integration and project management. The Frame Set is basically the parts you sit on, steer with, and to which you attach wheels and other parts. The Crank Set includes the pedals, bearings,

crank arms, and sprocket. The Braking System includes the brake pads and related mechanisms for the wheels, cables, and levers. The Shifting System includes the front and rear shift mechanism, cables, and levers. This level is numbered as #.# — for example, Frame Set is 1.1.

Level 3 – This level decomposes each major area from level 2 into its constituent parts. It is important to note that the 100% Rule is always adhered to in the development of a WBS. This level would tend to start targeting specific, tangible deliverables of the project effort. Here, Integration is decomposed into interim deliverables based on the integration life cycle chosen for this project. This level is numbered as #.#.#—for example, Rear Wheel is 1.3.2.

Level 4 – In the same manner, each exclusive area in Level 3 would be decomposed further, if applicable. Again, the complexity of the work will drive the depth and number of levels of the WBS decomposition. Note that Testing is further decomposed into three elements: Component Test is pre-assembly testing; Product Test is quality control and pre-customer test; and Customer Test is customer delivery, final adjustments, and customer acceptance. This level is numbered as #.#.#.#—for example, Product Test is 1.6.4.2.

4.5 Problem Diagnostic Checklist

Below are representative examples of major project problems resulting from key WBS defects.

- There are frequently missed deadlines and an extended schedule:
 - Have all major and minor deliverables been included? Failure to include all deliverables within the initial WBS can increase project schedules when missed deliverables are identified.
 - Have deliverables been defined specifically enough to allow for appropriate work packages to be developed?
 - Does the WBS facilitate the use of Earned Value Management techniques?
- Project is over budget:
 - Does the WBS provide logical summary points for assessing accomplishments, as well as for measuring costs and schedule performance?
 - Does the WBS facilitate the use of Earned Value Management techniques?
- Individuals are unable to use the new product or feature:
 - Are deliverables decomposed into smaller, more specific deliverables? For example, a deliverable of training might not be decomposed thoroughly enough to cover all of the people who need training to use the new product, process, or service.
 - Are the WBS elements deliverable-focused?
- The project scope has changed and is unmanageable:
 - Has a WBS been created for the project?
 - Does the WBS decompose the overall project scope into deliverables?
 - Does the WBS provide a level of flexibility for change?
 - Has the WBS been updated when necessary changes are approved by the Change Control process?
 - Has the WBS been placed under Change Control?
- The project has become an ongoing project with no end in sight:
 - Has a maintenance plan been developed for post implementation if needed?

- Does the project have a specific end point?
- Does the WBS include a closeout phase/plan?
- Is the endeavor actually a project—or is it an ongoing operation?
- Project team members are confused about their individual responsibilities:
 - Do the WBS elements define overlapping responsibilities for the creation of a deliverable?
 - Is the information within the WBS at the appropriate level of detail, and in formats and structures meaningful to those performing the work?
 - Do the WBS elements reflect work with specific, tangible deliverables?
 - Have all key stakeholders, including subject matter experts, contributed to the creation and validation of the WBS?
- Some planned work does not get done:
 - Has all required work been included in the WBS?
 - Are the WBS elements deliverable-focused?
 - Has the WBS organized around deliverables rather than process steps?
 - Was decomposition completed before dependencies and durations were defined?

4.6 Summary

There are several characteristics that need to be present to produce a quality WBS deliverable. For a WBS to be considered of high quality, it should conform to its original requirements and be fit for use by the project. More simply stated, it should satisfy the purpose for which it was originally intended.

In summary, a high-quality WBS:

- Is constructed in a consistent fashion, varying only in its level of focus based upon its intended use
- Satisfies the needs of the project
- Has all of the key elements to encompass the full scope of work
- Is usable by project managers with a broad base of experience to manage the varying degrees of scope, budget, schedule, and risk
- Avoids the common pitfalls associated with WBS construction.

Chapter 5 – Considerations While Creating a WBS

5.1 Overview

There are many ways to create a Work Breakdown Structure (WBS). It can be developed entirely as a new document, can reuse components from existing WBSs, can be based on a template, or can follow pre-defined WBS standards. When reusing existing components, WBS elements can be drawn from previous similar projects or from standard project templates that the organization has determined support accepted best practices.

This chapter discusses the methods used to create a WBS, as well as the considerations one should take into account during WBS development. The sections of this chapter are presented as guides for use during the WBS development process, and contain a number of topics for consideration. The remaining sections of this chapter are as follows:

- 5.2 – Preparing a WBS
- 5.3 – General Factors to be Considered
- 5.4 – Essential Considerations
- 5.5 – Judgments to be Made
- 5.6 – Project Manager Maturity
- 5.7 – WBS for Higher-Order Entities
- 5.8 – Summary

Some sections of this chapter can be used as checklists for the development and refinement of the WBS. All project, program, or higher order entity requirements need to be considered during development of the WBS. A critical factor for success at any level is the creation of a high-quality Work Breakdown Structure.

5.2 Preparing a WBS

The WBS evolves through an iterative consideration of the project's purpose and objectives (both business and technical), functional and performance design criteria, project scope, technical performance requirements, and other technical attributes. A high-level WBS can often be developed early in the conceptual stage of the project. Once the project is defined and specifications are prepared, a more detailed WBS can then be developed. It should be customized to the specific needs and requirements of the project. All non-required work and deliverables should be removed so the WBS represents only the project's scope. The end result is a WBS that represents the complete list of deliverables for the project.

The WBS can assist the project manager and stakeholders in communicating a clear vision of the end product(s) of the project, and of the overall process by which those products will be created. It helps communicate the work to be accomplished and the deliverables to be completed. With this in mind, the following list of questions should stimulate thought when developing a WBS to manage a project:

- Is the project charter defined and issued?
- Is the project scope statement defined and issued?

- Have the project manager and the team formulated a vision of the final product(s), services, or results?
- What are the project's constituent parts?
- How do the pieces work together?
- What needs to be done?
- Have the project's intended business objectives been defined? What is required to achieve the business value?
- Has the entire project been thought through? Have the high-level deliverables been progressively decomposed?
- Have all deliverables, both interim and final, been identified? What is to be provided? What is required?
- Has the relationship of each component to the end product been defined? How will this component contribute to the finished deliverables?
- Has the process for production of the deliverables been defined? What methods will be employed? What special processes will be needed? What are the quality requirements? What kinds of inspections need to be done?
- Have the activities that are needed to support the deliverables been identified, including those that directly or indirectly facilitate their creation?
- Has technical input from knowledgeable subject matter experts (SMEs) been obtained, and is that technical input communicated to and validated by other key SMEs assigned to the project?
- Have risks associated with project assumptions been identified and depicted?
- Does the project require any external sources to contribute to the project and have they been identified?
- Has all work associated with Risk Management been identified?

These thoughts and questions are intended to help the project manager develop a clear statement of what the product(s) of the project are. They should be iteratively reviewed until all questions have been completely addressed and all information is known—to the extent possible. Once completed, all of the work packages (i.e., the lowest-level WBS elements) should together comprise the complete list of deliverables for the project. They depict the project's scope.

5.2.1 Preparation Methods

There are many methods and tools that can be employed to create a WBS. These include outlines and organization charts, fishbone and brainstorming techniques, top-down and bottom-up development strategies. There are many WBS templates available and corporate guidelines or standards can be referenced or copied for quick-starting WBS development.

There are many benefits to using tools to develop a WBS. For example, tools often promote consistency and repeatability in the development of a WBS, especially if it is an enterprise productivity tool. WBS tools can also promote and enforce the principles of the organization's WBS guidelines or standards, and can significantly reduce the development effort, simplify the WBS process, and even promote reuse of WBS elements.

Some of the more popular methods employed to create a WBS include a top-down approach, a bottom-up approach, the use of organization-specific WBS guidelines or standards, and the use of WBS templates. The choice of appropriate method should be based on the specific project objectives, requirements, assumptions, and constraints. The following table highlights some advantages and challenges of the aforementioned methods.

WBS Creation Method	Advantages	Challenges
Top-Down	<ul style="list-style-type: none"> • Structures project conveniently for status reporting • Ensures projects are logically structured • Is valuable when brainstorming / discovering project deliverables • Can accommodate additional deliverables as they are uncovered 	<ul style="list-style-type: none"> • Requires constant attention that no work packages are overlooked • WBS needs to be elaborated to sufficiently detailed level to permit management
Bottom-Up	<ul style="list-style-type: none"> • Starts with all deliverables and works backwards into a project • Confirms that the bodies of identified work packages are included 	<ul style="list-style-type: none"> • Identifying all deliverables before producing the WBS • Making sure work packages are logically grouped • Can lose focus on big picture
WBS Standards	<ul style="list-style-type: none"> • Formats are predefined • Enhances cross-project WBS consistency 	<ul style="list-style-type: none"> • Making a project fit the standard • Can lead to inclusion of unnecessary deliverables or failure to include project-specific deliverables • Not all projects fit into a highly structured set of WBS standards
WBS Templates	<ul style="list-style-type: none"> • Provides a starting point for WBS creation • Predetermines levels of detail • Enhances cross-project WBS consistency 	<ul style="list-style-type: none"> • Requires a project fit the standard • Can lead to inclusion of unnecessary deliverables or failure to include project-specific deliverables • Not all projects fit into a highly structured set of WBS templates

Table 5-1. WBS Creation Methods

Top-Down:

The following steps describe the general top-down process for developing a WBS:

- Step 1: Identify the final products of the project—what must be delivered to achieve project success. A thorough review of high-level project scope documents (such as Statement of Work and Technical Requirements) is recommended to ensure consistency between the WBS and the project requirements.
- Step 2: Define the project’s major deliverables, which are often interim deliverables necessary for the project, but which in themselves do not satisfy a business need (such as a design specification).
- Step 3: Decompose major deliverables to a level of detail appropriate for management and integrated control. These WBS elements are normally tied to clear and discrete identification of stand-alone deliverable products. The sum of the elements at each level should represent 100% of the work in the element above it, as noted in the 100% Rule. Each work package of the WBS should contain one, and only one, deliverable.
- Step 4: Review and refine the WBS until project stakeholders agree that project planning can be successfully completed, and that execution and control will successfully produce the desired deliverables and results.

Bottom-Up:

The following steps describe the general bottom-up process for developing a WBS:

- Step 1: Identify all of the deliverables (or work packages) involved in the project. This will encompass the entire output of the effort. Each work package, again, should contain one, and only one, deliverable.
- Step 2: Logically group related work packages (or deliverables) together.
- Step 3: Aggregate deliverables to the next level, for instance, the parent level. The sum of the elements at each level should represent 100% of the work below it, as noted in the 100% Rule.
- Step 4: Once a given group of related tasks has been aggregated to a parent, analyze the subset again to ensure that all of the work has been encompassed.
- Step 5: Repeat until all sub-elements have been aggregated to a single parent representing the project. Ensure that the completed structure includes all of the project scope.

WBS Standards:

A WBS standard is a set of rules for constructing a WBS and might include a format, numbering scheme, naming conventions, or required work elements. WBS standards are common in many organizations with a high level of project management maturity. WBS standards help ensure consistency and completeness in WBSs throughout the organization. Examples of WBS standards include the following:

- Project management must be a Level 2 WBS element.
- Graphical and textual WBS views must be developed and maintained.

WBS Templates:

A WBS template is a sample WBS, with hierarchical elements filled in to some level of detail, or a generic WBS “container” that is customized (i.e., filled) with project-specific information. An organization can have templates for different types of projects and different life cycles.

The use of WBS standards and WBS templates helps promote consistency through reuse of WBSs or WBS components. When reusing existing components, be sure to customize the WBS to the specific needs and requirements of the project. Any non-required work or deliverables should be removed so that the WBS is aligned with the project scope. In addition, the questions defined in Section 5.2 should again be iteratively reviewed for these two methods. The use of standards and templates in the creation of WBSs helps promote quality assurance through the application of successfully applied WBS best practices.

The use of WBS standards and WBS templates differs from top-down and bottom-up methodology in that top-down and bottom-up are methods of creating WBSs from scratch, while standards and templates involve the reuse of existing materials.

5.2.2 Guidance in Choosing a Method for Preparing a WBS

In developing a WBS, the project management team needs to decide first which development method to use. The choice between a top-down or a bottom-up approach is somewhat personal, and can depend on the habits and thinking styles of the project team, as well as on organizational practices. Aside from those considerations, some guidelines and explanations for which approach might be more appropriate are as follows:

Top-Down:

Use the top-down approach in these situations:

- The project manager and project management team have little to no experience in developing a WBS. Top-down development allows for progressive understanding and elaboration of the WBS.
- The nature of the project's products or services is not well understood. The development of a WBS jointly with all stakeholders using the top-down approach is useful in gaining understanding and consensus when the scope and nature of the project is unclear.
- The nature of the project life cycle is not familiar or well known. Top-down development of the WBS more easily uncovers life cycle issues and characteristics.
- No appropriate WBS templates are available. When developing a WBS "from scratch," it is far easier to start with the overall project deliverable, such as building a bicycle, and then iteratively determine sub-elements.

Bottom-Up:

Use the bottom-up approach in these situations:

- The nature of the project's products or services is well understood. For example, if the organization has developed very similar products or services on previous projects, the project team might already have a very good understanding of all interim deliverables required for the new project.
- The nature of the project life cycle is well known. If the organization always uses the same project life cycle, the interim deliverables for that life cycle are well known and can be used to begin bottom-up WBS development.
- Appropriate WBS templates are available. If the organization has WBSs from projects with similar products or services, and these can be reused, a bottom-up approach

enhances the team's ability to customize the WBS template.

WBS Standards and Templates:

In general, if WBS standards or WBS templates are available, they should be used, with the caveats expressed in Figure 5-1. There are plenty of sample WBSs available in the literature, but the choice to use sample WBSs as templates must be made carefully. The organization can have WBS templates for very similar projects, and the use of these templates is highly encouraged. However, if the project significantly differs from other projects in the organization, and no template seems to apply, develop the WBS "from scratch" with a top-down approach.

Regardless of what method is chosen to prepare the WBS, the resulting WBS must have all the core characteristics of a high-quality WBS. The WBS must describe 100% of the work on the project, must be oriented toward deliverables rather than activities, and must be hierarchically arranged. For additional details on WBS Quality Principles, please see Chapter 4, and specifically Section 4.2 for a discussion of WBS Core Quality Characteristics.

5.3 General Factors to Be Considered

In developing a WBS, the following basic tenets should be considered:

- Each WBS element represents a single tangible or intangible deliverable.
- Deliverables include both final and interim deliverables that are required to create the final results.
- Deliverables include intangible items, such as information/communication, integration, training, process management, and provisioning.
- All deliverables are explicitly included in the WBS.
- Deliverables are unique and distinct.
- All significant reporting mechanisms, such as review meetings, monthly reports and test reports, are included and identified in the WBS.
- Deliverables are clearly defined to eliminate duplication of effort within WBS elements, across organizations, or among individuals responsible for completing the work.
- Accountability for each work package can be assigned to a single project team member. If this is not possible, then reconsider whether or not the work package can be further decomposed.
- Each element in the WBS representing subcontracted or externally committed deliverables directly corresponds to matching elements in the subcontractor's WBS.
- The deliverables are logically decomposed to the level that represents how they will be produced and managed (e.g., designed, purchased, subcontracted, or fabricated).
- All WBS elements are compatible with organizational and accounting structures.

The following basic guidelines should be considered when organizing WBS elements into the WBS hierarchy:

- Each WBS element belongs to only one parent WBS element.
- The set of child elements into which a parent element is decomposed includes all of the work contained in the parent, such that the 100% Rule applies.

- A coding scheme is used for WBS elements that clearly represents the hierarchical structure when viewed in text format.
- All “legs” of the WBS need not be to the same depth. Some areas of the WBS will need to show more detail than others.
- There is no need to have all work packages at the same level.

The WBS development process should:

- Be iterative.
- Be reviewed and revised as the rest of the project planning process progresses.
- Provide a vehicle for flexibility, particularly when the scope of the project effort might change.

A well-managed project, however, will incorporate a rigorous Change Control process to document and manage scope changes. When work scope changes do take place, the WBS must be updated. Any change in the WBS requires an associated change in related project management tools, such as the WBS Dictionary, network diagram, and schedule.

5.3.1 Project Management Knowledge Area Considerations

In the iterative WBS development process, the following guidelines and questions should be considered as they relate to each Project Management Knowledge Area in the *PMBOK® Guide*—Third Edition:

Project Integration Management

- Include work in the WBS for the integration of components. Place the WBS element for component integration at the same level as the components being integrated.
- Include work in the WBS for the necessary communications and meetings required for effective integration management.
- Is the work defined by the WBS grouped in a logical manner? Have all reporting and control mechanisms been addressed?

Project Scope Management

- WBS development is critical to Scope Management. Revisit the WBS often and expect to iterate WBS development.
- Are requirements defined and approved?
- Is there a statement of work, a set of contract requirements, or other documented requirements? Be sure that each WBS element can be traced to these requirements. Include only those activities that are considered in scope and can be traced to contractual or other requirements.
- As the WBS is defined, keep a list of activities and efforts that are considered to be out of scope. Confirm scope with stakeholders often by reviewing the WBS and the out of scope list.
- Are all deliverables explicitly identified in the WBS?
- Will horizon or rolling wave planning be applied to develop the scope progressively over time?

- Have historical data, risk registries, checklists, and lessons learned been consulted to ensure identification of all work?

Project Time Management

- Deliverables should be decomposed to the level of detail needed to estimate the effort required to obtain or create them.
- How will the status of work in progress be determined?

Project Cost Management

- Deliverables should be limited in size and definition for effective control—not so small as to make cost of control excessive, and not so large as to make the item unmanageable or the risk unacceptable.
- How will budgets be established?
- Will it be possible to relate the budget to the proposed work assignments?
- Is the level of detail in the WBS appropriate for effective planning and control?

Project Quality Management

- Will the quality of the work be evaluated through efforts such as testing and inspection?
- Are there quality requirements on the project? If so, be sure to include WBS elements to document the periodic review of quality requirements, quality management activities, quality audits, and quality reviews.
- Are there requirements to show compliance with ISO or other standards? If so, include WBS elements for outside auditing of the project for compliance.
- Are there quality requirements defined for the deliverables outlined in the WBS?
- Have metrics been defined for how the deliverables will be measured?

Project Human Resource Management

- Ensure that each WBS element has a single point of accountability. If a WBS element might involve more than one accountable person, consider decomposing the WBS element.
- Is all the work planned to a degree of detail necessary to make and keep commitments?
- Ensure that the reporting structure indicated by this WBS supports establishing and managing individual work assignments.
- Can work assignments be established from a progressive expansion of the WBS?
- How will work generally be assigned and controlled?
- Will it be possible to reconcile individual work assignments to the formal scheduling system?
- Is more than one organization involved, requiring validation of the WBS with others before doing detailed resource planning?

Project Communications Management

- Have all communication needs been accounted for?
- Are there long-distance communications on the project?
- Are there any special deliverables required for international communications, such as translations and other country-specific requirements?

- Are there special communication needs for any deliverables outlined in the WBS?

Project Risk Management

- For areas of the WBS that are considered high-risk, consider decomposing the WBS to a more detailed level. This will allow better definition of assumptions and expectations, and will allow for more accurate planning, thus reducing risk.
- Are the deliverables completely and clearly defined?
- What is the likelihood of change?
- Is the technology changing faster than the project can be accomplished?
- Have manpower, facilities capability, availability of internal resources, and potential suppliers been checked?
- Has a formal change process been defined and implemented?
- Have metrics been defined for how the deliverables will be measured?
- Have resource requirements been identified for development of the project deliverables?
- Have other risks been identified, including stakeholder buy-in, public relations, management approval, team understanding, and project opposition?
- Has both an internal and external communication plan been defined and implemented?
- Are third-party dependencies understood and monitored for change?
- Have alternate suppliers of required products, supplies, or expertise been identified?
- Have historical data, risk registries, checklists, and lessons learned been consulted to ensure identification of all risks?
- Has risk management and contingency work been included?

Project Procurement Management

- Is extensive subcontracting expected?
- Is there a WBS element for each procured deliverable?
- Are intangible deliverables required for managing the procurement process?
- Will procurement be managed by the project team or by an existing procurement organization?

5.4 Essential Considerations

There are several points that are considered essential when creating a WBS. As detailed in Chapter 4, there is a set of Core Characteristics that every WBS must have, which enable it to satisfy project needs. Failure to address these considerations can lead to failure of the project, because there would be a high risk of not identifying all of the required work.

Core Characteristics:

- The WBS structure is not based on timing or sequence dependencies among components. Timing, sequencing, and dependencies are project schedule concerns.
- The WBS is not structured strictly by process or organization.
- The WBS defines the logical relationships among all the components of the project.
- All WBS elements are deliverable-oriented.
- Tasks and activities of the project are not listed, as these are components of the project schedule, not the WBS.

- All element names are nouns. Verbs are not used to define WBS elements.
- The WBS includes only sufficient and necessary deliverables. All deliverables are necessary components of the project's product, service, or end result, and are defined in the project's scope.
- All project deliverables including regulatory permits, packaging, distribution, or marketing, as well as preliminary, interim, internal, external, or final deliverables, are identified and detailed.
- There are no WBS elements with overlapping responsibilities for the creation of a deliverable(s). Each WBS element must have one person who is clearly accountable for its completion.

Also, as discussed in Chapter 4, there is an additional set of “Use-related Characteristics” that might vary from one WBS to another. These characteristics enable the use of the WBS for purposes that can be unique to a specific project, industry, or environment, or are applied in a particular way on individual projects. With respect to Use-Related Characteristics, the quality of the WBS depends on how well the specific content and type of WBS elements meet the use for which the WBS was intended.

Use-Related Characteristics:

- Identify key project management work such as:
 - Initiating, planning, executing, monitoring and controlling, and closing
 - Process management
 - Services and provisioning
 - Information/communication
 - Administrative documentation, training, and software.
 These should be defined as level-of-effort WBS elements in those cases where they can be interim deliverables, do not themselves generate discrete deliverables, and might not be included in the final-project deliverables.
- Include cross-project WBS elements, such as those representing opening and closing stages—planning, assembly, integration, and testing.
- Balance the project definition aspects of the WBS with the data collecting and reporting requirements. The primary purpose of the WBS is to define the project's scope through the decomposition of deliverables.
- Decompose the WBS to the appropriate level of detail by achieving a balance between project complexity, risk, and the project manager's need for monitoring and control.
- Do not decompose the WBS too far. Each WBS is a tool designed to assist the project manager with decomposition of the project only to the levels necessary to meet the needs of the project, the nature of the work, and the confidence of the team. Excessive WBS levels can require unrealistic levels of maintenance and reporting.
- Do not omit WBS development, such as Gantt chart, CPM schedule or precedence diagram before proceeding to the network diagram. Omitting the development and refinement of the WBS can lead to unforeseen and unexpected difficulty, including project delays, cost over-runs, or outright project failure.

5.5 Judgments to be Made

Effective application of use-related characteristics relies on experience and judgment. This section examines that concept in a bit more detail. Factors that can vary from one project or application to another—depending on the purpose for which the WBS is intended—include, but are not limited to, the level of detail needed in the decomposition of the deliverables, the selection of the type of WBS element to be included, and structuring the logic of the decomposition.

5.5.1 Determining Appropriate WBS Level of Detail

The WBS development process has been described as proceeding to successive levels of increasing detail, until a level is reached that provides the needed insight for clear communications and effective project management. The level of detail in a WBS is a function of the size of the project, and reflects a balance between complexity, risk, and the project manager's need for control. The level of detail can also vary during the evolution of a project. A top-down and bottom-up analysis of the WBS can clarify whether the WBS is both complete and defined at the proper level of detail.

Short-duration projects can lend themselves to decomposition to a high degree of detail at the outset, while projects of longer duration and higher complexity can preclude decomposition of all deliverables until more is known about the project. Again, this means that on any given project, some portions of the WBS can have different levels of decomposition. This is especially true when doing rolling wave planning, where the plan is detailed only for the immediately upcoming work, and work far in the future is defined at a high level until later in the project life cycle.

When proceeding to successive levels of increasing detail, it is important to note that the 100% rule must still apply. This rule states that the children nodes of a parental node must make up 100% of the work of that parental node. Additionally, not all legs of the WBS must be symmetrical in terms of the number of levels developed. There is no need to decompose all legs of the WBS if the need is only present in one area.

Should the WBS be decomposed further? The following questions provide guidance for determining the need for further decomposition of the WBS. If the answer to any of these questions is yes, then further decomposition should be considered. The greater the number of positive answers, the stronger the justification for further division of some or all of the WBS.

Scope and Work Package Detail

- Are clear, objective criteria missing for measuring progress for the WBS element?
- Does the WBS element contain more than one deliverable?
- Do prerequisites differ among internal deliverables within the WBS element?
- Can a portion of the work to be performed within the WBS element be scheduled as a unit?
- Are there acceptance criteria applicable before completion of the entire WBS element?
- Is the WBS element clearly and completely understood to the satisfaction of the project manager, project team members, and other stakeholders—including the customer?

- Are there relationships between internal WBS element deliverables and other external WBS elements?
- Is there a stakeholder interested in analyzing status and performance of only a portion of the work covered by the WBS element?
- Can progress of the work be assessed as needed?

Resources and Risks

- Can the work element be assigned to a single accountable individual? While there might be a variety of resources assigned to a given WBS element, there should ultimately be only one individual accountable for delivery of the work package.
- Are there specific risks that require focused attention to a portion of the WBS element?
- Can actionable risks be identified for each WBS element?

Costs and Timing

- Are there significant time gaps in the execution of the work processes internal to the WBS element?
- Is there a need to improve the accuracy of the cost and duration estimates of the WBS element?
- Is there a need to separately define the cost of work processes or deliverables internal to the WBS element?
- Is there a need to precisely know and report the timing of deliverables internal to the WBS element?

5.5.2 Selection of the Type of WBS Element to be Included

A WBS organizes and defines the total work scope of the project. Not every WBS, however, needs to include all types of work. Rather, the kinds of work included in a specific WBS depend on the purpose for which the WBS is intended. Some examples of this are presented here.

- Some projects require certain types of WBS elements that are not necessary for other projects. For example, in a project that involves production of several different components that need to be assembled into a finished product, it would be necessary to include an integration or assembly WBS element so that the assembly work can be identified, resourced, tracked, and reported. In contrast, a project to develop a business process might not require such an assembly element.
- All projects require a project management WBS element at level 2, in order to ensure that the work of planning, tracking, and reporting is adequately captured and managed. A particular organization, however, might require use of a standardized WBS template that does not include certain kinds of project management WBS elements—for example, administration, documentation, or reporting elements—perhaps because the need for these is adequately addressed by other business processes established by that organization. In such cases, these elements would not be required.
- Quality assurance is applicable to all projects. Some organizations could have requirements for compliance with specific quality standards. In such cases, the WBS must include elements, such as documentation and audits, to account for compliance with the specified procedures.

5.5.3 Structuring the Logic of the Decomposition

An essential feature of a WBS is that it clearly and comprehensively defines the scope of the project work through decomposition of deliverables into a hierarchy of simpler components, thereby providing one of the primary methods for managing complex projects. The way that the project manager decomposes the project (i.e., the logic used for decomposing the work) can vary depending on the needs and requirements of the performing organization and the use to which the WBS will be put. This is illustrated by the following examples:

- One organization might be structured along very strict functional lines, with few business processes that facilitate communication among the separate sub-units. In such a case, it can make sense to structure the decomposition in terms of the work and sub-deliverables that each function independently contributes. In contrast, in a projectized organization without functional divisions, the same deliverable might more effectively be decomposed into a hierarchy of sub-assemblies.
- Where new product development proceeds in sequential stage-like phases with later work contingent on the outcome of earlier work, it would make sense to organize the WBS in terms of the product development life cycle, rather than in terms of physical components of the product.
- A food-service enterprise with regional offices might find it particularly valuable to structure the WBS for a program to create a new chain of restaurants as a series of geographic subprojects, while a centralized enterprise that sub-contracts, for instance, building development, food sourcing, or marketing, would find it more useful to decompose the new restaurant program in terms of sub-systems.

In all cases, it is important that the WBS remain deliverable-oriented, rather than process-oriented, and explicitly contain all intermediate deliverables.

5.6 Project Manager Maturity

A WBS can only meet the needs of a project if the project manager knows how to apply it.

There is a continuum of practitioner competency or skill level, such that an experienced project manager will be able to identify a greater range of stated and implied project needs that the WBS can address. A more experienced project manager will ensure the WBS is employed in a greater variety of project roles, and will use the WBS in more efficient and sophisticated ways than will a novice or inexperienced project manager. A WBS can be of high quality even if it is not being used to its full capacity.

A competency continuum can be applied to the project managers' development and use of the WBS as an effective planning and control tool. This continuum can be applied in a manner similar to that applied in the *Practice Standard for Project Scheduling*. In other words, once practitioners begin using a WBS within the project context, their ability to make the WBS play an important defining and controlling role for scope, budget, and risk follows a growth continuum similar to that of any other project management methodology or tool. The following is an experience continuum for WBS development and use:

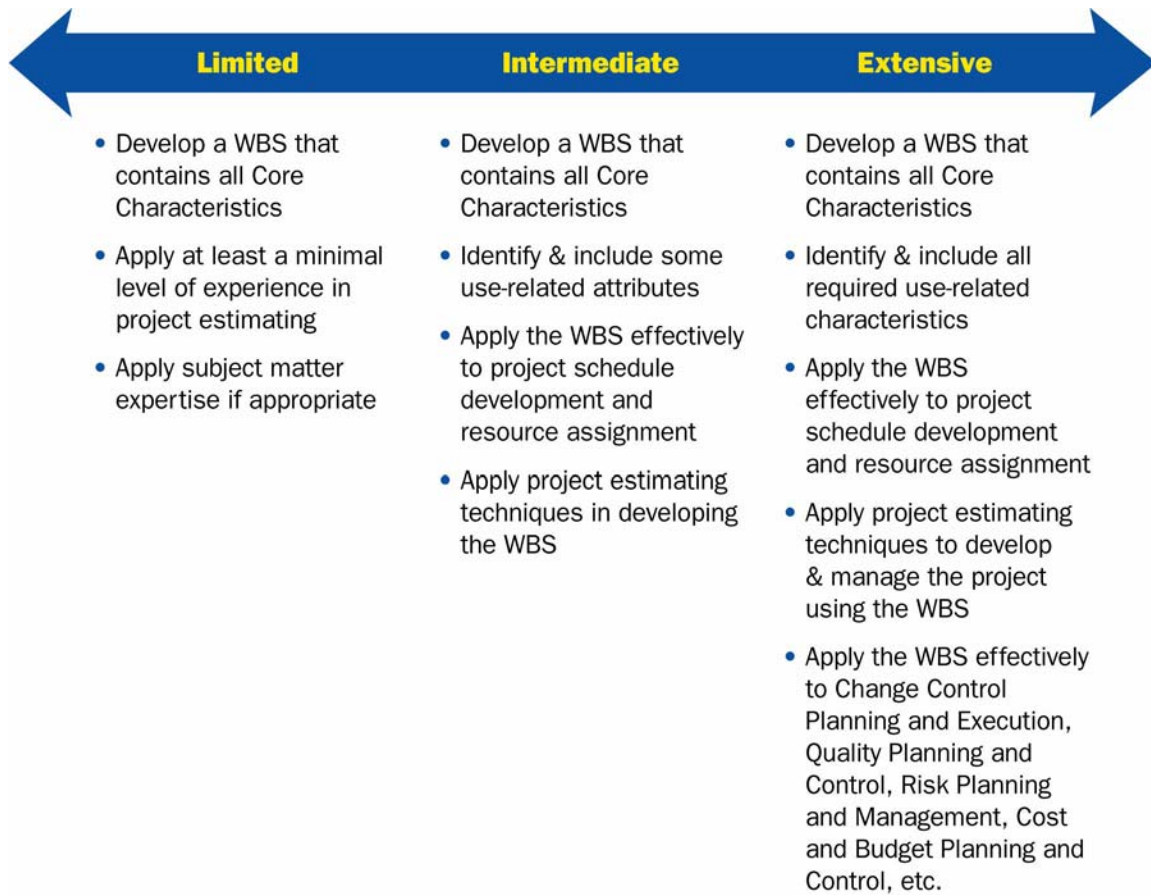


Figure 5-1. Project Management Experience Level Continuum

5.7 WBS for Higher-Order Entities

According to the *PMBOK® Guide*—Third Edition, projects and programs are defined as follows:

Project A temporary endeavor undertaken to create a unique product, service, or result.

Program A group of related projects managed in a coordinated way to obtain benefits and control not available from managing them individually. Programs may include elements of related work outside of the scope of the discrete projects in the program.

Work Breakdown Structures are useful not only for projects, but for programs and higher-order entities as well. There is no essential difference among a project WBS, a program WBS, or the WBS of any higher-order entity. A high-quality WBS developed at any of these broader levels possesses precisely the same characteristics and attributes as a high-quality WBS developed at the individual project level. These differ only in the breadth of the content (scope). Essentially, a WBS is a WBS is a WBS!

As with a project-level WBS, the sum of the elements at the next level of decomposition must represent 100% of the work of that element. In other words, the 100% Rule must still apply, even when defining WBSs for programs or any higher-order entity. When defining a higher-order entity WBS, not only does the 100% Rule apply, but all the considerations and concepts defined in this practice standard do so as well.

Great care should be taken, however, when working with WBSs beyond the program level. Difficulty of verifying that all work and deliverables are defined increases significantly as the scope increases. Remember, during the process of WBS creation, one must decompose each level element by element.

5.8 Summary

This chapter has shown that there are many ways a WBS can be created. It can be developed as an entirely new document, can reuse components from existing WBSs, can be based on a template, or can follow predefined WBS standards. Regardless of the method used to construct it, the WBS evolves through an iterative consideration of the project's scope, including the project's purpose and objectives (both business and technical), functional and performance design criteria, technical performance requirements, and other technical attributes.

This chapter has presented several guidelines and checklists to assist in the preparation of a WBS. All other Project Management Knowledge Areas (such as Project Time Management, Project Cost Management, and Project Quality Management) are highly dependent upon the resulting WBS. In the end, a high-quality WBS provides a strong foundation upon which to build a successful project.

References

Haugan, Gregory T. (2002). *Effective Work Breakdown Structures*. Vienna, VA: Management Concepts.

Project Management Institute. (2004). *A Guide to the Project Management Body of Knowledge (PMBOK® Guide)*—Third Edition. Newtown Square, PA: Project Management Institute.

Glossary

Activity. A component of work performed during the course of a project.

Control Account (CA). A management control point where the integration of scope, budget, actual cost, and schedule takes place, and where the measurement of performance will occur. Control accounts are placed at selected management points (specific components at selected levels) of the Work Breakdown Structure. Each control account may include one or more work packages, but each work package may be associated with only one control account. Each control account is associated with a specific single organizational component in the Organizational Breakdown Structure (OBS). Previously called a cost account. See also *work package*.

Customer. The person or organization that will use the project's product, service, or result. See also *user*.

Decomposition. A planning technique that subdivides the project scope and project deliverables into smaller, more manageable components until the project work associated with accomplishing the project scope and providing the deliverables is defined in sufficient detail to support executing, monitoring, and controlling the work.

Deliverable. Any unique and verifiable product, result, or capability to perform a service that must be produced to complete a process, phase, or project. Often used more narrowly in reference to an external deliverable, which is a deliverable that is subject to approval by the project sponsor or customer.

Level of Effort (LOE). Support-type activity (e.g., seller or customer liaison, project cost accounting, project management, etc.) that does not readily lend itself to measurement of discrete accomplishment. It is generally characterized by a uniform rate of work performance over a period of time determined by the activities supported.

Organizational Breakdown Structure (OBS). A hierarchically organized depiction of the project organization arranged so as to relate the work packages to the performing organizational units.

Phase. See *project phase*.

Product Scope. The features and functions that characterize a product, service, or result.

Progressive Elaboration. Continuously improving and detailing a plan as more detailed and specific information and more accurate estimates become available as the project progresses, thereby producing more accurate and complete plans that result from the successive iterations of the planning process.

Project Phase. A collection of logically related project activities, usually culminating in the completion of a major deliverable. Project phases (also called phases) are mainly completed sequentially, but can overlap in some project situations. Phases can be subdivided into subphases

and then components; this hierarchy, if the project or portions of the project are divided into phases, is contained in the Work Breakdown Structure. A project phase is a component of a project life cycle. A project phase is not a Project Management Process Group.

Project Scope. The work that must be performed to deliver a product, service, or result with the specified features and functions.

Resource Breakdown Structure (RBS). A hierarchical structure of resources by resource category and resource type used in resource leveling schedules and to develop resource-limited schedules, and which may be used to identify and analyze project human resource assignments.

Responsibility Assignment Matrix (RAM). A structure that relates the project Organizational Breakdown Structure to the Work Breakdown Structure to help ensure that each component of the project's scope of work is assigned to a responsible person.

Risk. An uncertain event or condition that, if it occurs, has a positive or negative effect on a project's objectives.

Scope. The sum of the products, services, and results to be provided as a project. See *project scope* and *product scope*.

Scope Change. Any change to the project scope. A scope change almost always requires an adjustment to the project cost or schedule.

Stakeholder. Persons and organizations, such as customers, sponsors, performing organization, and the public, that are actively involved in the project, or whose interests may be positively or negatively affected by execution or completion of the project. They may also exert influence over the project and its deliverables.

Standard. A document established by consensus and approved by a recognized body that provides, for common and repeated use, rules, guidelines, or characteristics for activities or their results, aimed at the achievements of the optimum degree of order in a given context.

Statement of Work (SOW). A narrative description of products, services, or results to be supplied.

Task. A term for work whose meaning and placement within a structured plan for project work varies by the application area, industry, and brand of project management software.

User. The person or organization that will use the project's product or service. (See also *Customer*.)

Work Breakdown Structure (WBS). A deliverable-oriented hierarchical decomposition of the work to be executed by the project team to accomplish the project objectives and create the required deliverables. It organizes and defines the total scope of the project. Each descending level represents an increasingly detailed definition of the project work. The WBS is decomposed

into work packages. The deliverable orientation of the hierarchy includes both internal and external deliverables. See also *work package* and *control account*.

Work Breakdown Structure Component. An entry in the Work Breakdown Structure that can be at any level.

Work Breakdown Structure Dictionary. A document that describes each component in the Work Breakdown Structure (WBS). For each WBS component, the WBS dictionary includes a brief definition of the scope or statement of work, defined deliverable(s), a list of associated activities, and a list of milestones. Other information may include: responsible organization, start and end dates, resources required, an estimate of cost, charge number, contract information, quality requirements, and technical references to facilitate performance of the work.

Work Breakdown Structure Element. Any single component of a Work Breakdown Structure.

Work Package. A deliverable or project work component at the lowest level of each branch of the Work Breakdown Structure. The work package includes the schedule activities and schedule milestones required to complete the work package deliverable or project work component. See also *control account*.

Appendix F

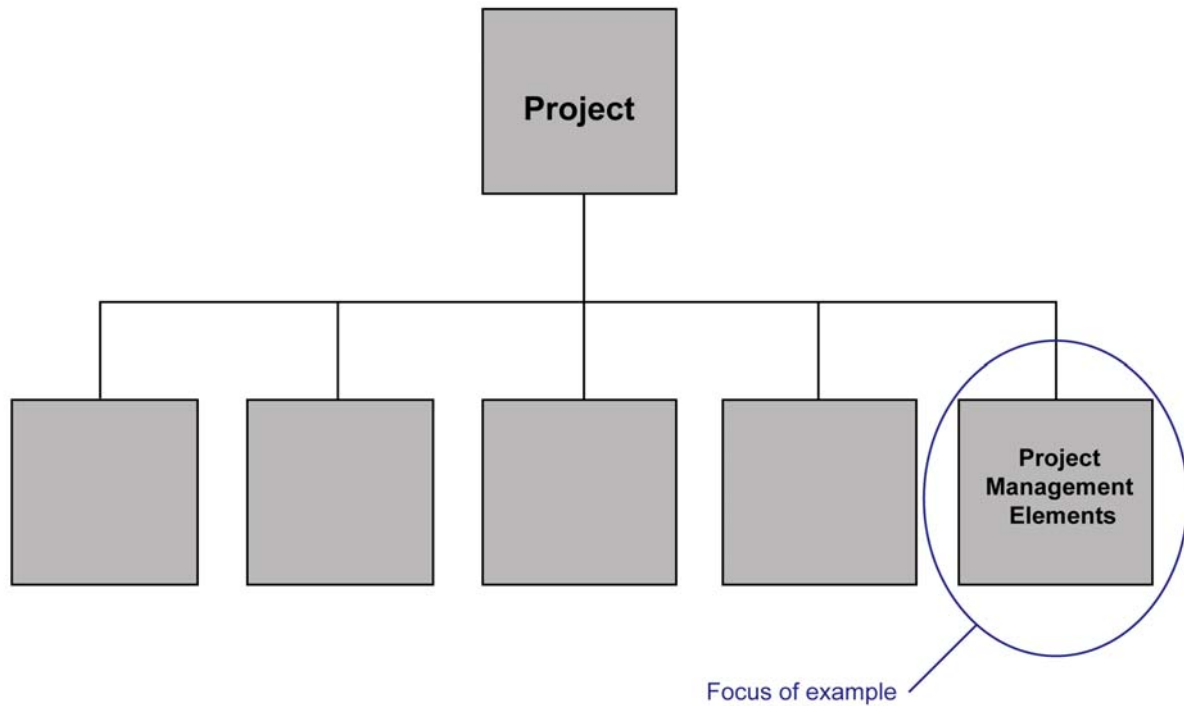
WBS for Project Management Deliverables Example

The following example depicts the decomposition of the project management (PM) deliverables of a larger Work Breakdown Structure. The PM example is included here in response to numerous requests received by the Work Breakdown Structures Practice Standard Update Team to present a template that can be used to help the practitioner ensure all project management deliverables are clearly articulated in the project's WBS. The example depicts one way that project management deliverables may be decomposed, but not necessarily the only way. The decomposition of the project management deliverables should be tailored to meet the needs of each specific project.

As you will notice, this WBS example is organized to reflect the nine Knowledge Areas defined in the *PMBOK® Guide*—Third Edition. The example includes the PM deliverables associated with each Knowledge Area and also includes many key references to the *PMBOK® Guide*. (Since this is not an exhaustive list, some cells under the “WBS Dictionary” header have intentionally been left blank) To create this example, the Work Breakdown Structures Practice Standard Update Team carefully researched each element and followed its path through the entire body of the *PMBOK® Guide*.

The WBS for project management deliverables is not presented in “organization chart” style, but rather as a hierarchically organized table that includes not only the WBS element names, but their appropriate WBS level, numbering scheme representation, definition, and references to the relevant chapter of the *PMBOK® Guide*. Also, please note that the numbering scheme of the WBS for project management deliverables begins at level 2 – and names the deliverables starting with the label “x.n”. This is done to show that these deliverables exist as part of a larger WBS – that the entire scope of the project would be defined and described above this level (at level 1) and would include 100% of the project's work – of which the project management deliverables would be just one part.

To ensure clarity for the example, the following figure shows (in organization chart format) where this example would be placed in the project's overall WBS hierarchy:



Finally, by presenting the example as a table rather than an organization chart, we are able to provide more than a view of project management deliverables organized in hierarchical context; with this format, we are also able to illustrate some of the components that make up a framework for the WBS Dictionary, including a description of each element, as well as its linkage to the Project Management Body of Knowledge. The resulting example can be used as a guide for developing the WBS elements for project management deliverables as well as the WBS Dictionary.

Work Breakdown Structure			WBS Dictionary	
WBS Level	WBS Code	WBS Element Title	Description	PMBOK® Guide References (Sample)
1	x	Project Name	Entire project scope including all other project deliverables. Represents 100% of the project scope.	
2	x.n	Project Management		
3	x.n.1	Integration	Documentation required to identify, define, combine, unify and coordinate the various processes and project management activities.	

Work Breakdown Structure			WBS Dictionary	
WBS Level	WBS Code	WBS Element Title	Description	PMBOK® Guide References (Sample)
4	x.n.1.1	Project Charter	A document issued by senior management that formally authorizes the existence of a project. And it provides the project manager with the authority to apply organizational resources to project activities. It can include market demand as well as the project's business case.	1.4.3 Section III: The Project Management Knowledge Areas 3.2.1 Initiating Process Group Figure 3-5. Project Boundaries 3.2.1 (Develop Project Charter) Table 3-1. Develop Project Charter: Inputs and Outputs 3.2.1 (Develop Preliminary Project Scope Statement) 4.1.3 Develop Project Charter: Outputs
4	x.n.1.2	Project Management Plan	A formal, approved document that defines how the project is executed, monitored, and controlled. It may be summary or detailed and may be composed of one or more subsidiary management plans and other planning documents.	3.2.2 Planning Process Group Figure 3-7. Planning Process Group 3.2.2.1 Develop Project Management Plan 4.3 Develop Project Management Plan 4.6.3 Integrated Change Control: Outputs 5.5.3 Scope Control: Outputs 6.5.3 Schedule Development: Outputs 6.6.3 Schedule Control: Outputs
5	x.n.1.2.1	Scope Management Plan	Provides guidance on how the project scope will be defined, documented, verified, and managed.	3.2.2.2 Scope Planning Table 3-4. Scope Planning: Inputs and Outputs 5.1.3 Scope Planning: Outputs 5.2.3 Scope Definition: Outputs 5.3.3 Create WBS: Outputs
5	x.n.1.2.2	Cost Management Plan	The document that sets out the format and establishes the activities and criteria for planning, structuring, and controlling the project costs.	7.1.3 Cost Estimating: Outputs 7.2.1 Cost Budgeting: Inputs 7.2.3 Cost Budgeting: Outputs

Work Breakdown Structure			WBS Dictionary	
WBS Level	WBS Code	WBS Element Title	Description	PMBOK® Guide References (Sample)
5	x.n.1.2.3	Quality Management Plan	Describes how the project management team will implement the performing organization's quality policy.	8.1.3 Quality Planning: Outputs 8.2.1 Perform Quality Assurance: Inputs 8.3.1 Perform Quality Control: Inputs
5	x.n.1.2.4	Staffing Management Plan	The document that describes when and how human resource requirements will be met.	9.1 Human Resource Planning 9.1.3 Human Resource Planning: Outputs 9.2.1 Acquire Project Team: Inputs 9.2.3 Acquire Project Team: Outputs 9.3.1 Develop Project Team: Inputs 9.4.1 Manage Project Team: Inputs
5	x.n.1.2.5	Schedule Management Plan	Describes when and how scheduling requirements will be met.	
5	x.n.1.2.6	Communications Management Plan	Describes: the communications needs and expectations for the project; how and in what format information will be communicated; when and where each communication will be made; and who is responsible for providing each type of communication.	
5	x.n.1.2.7	Risk Management Plan	Describes how project risk management will be structured and performed within the project.	
5	x.n.1.2.8	Procurement Management Plan	Describes how procurement processes from developing procurement documentation through contract closure will be managed.	
5	x.n.1.2.9	Contract Management Plan	Describes how a specific contract will be administered and can include items such as required documentation delivery and performance requirements.	
4	x.n.1.3	Controlled Changes	Impacts or potential impacts to the project that must be controlled.	

Work Breakdown Structure			WBS Dictionary	
WBS Level	WBS Code	WBS Element Title	Description	PMBOK® Guide References (Sample)
5	x.n.1.3.1	Change Requests	Requests to expand or reduce the project scope, modify policies, processes, plans, or procedures, modify costs or budgets, or revise schedules. Requests for a change can be direct or indirect, externally or internally initiated, and legally or contractually mandated or optional. Only formally documented change requests are processed, and only approved change requests are implemented.	4.4.3 Direct and Manage Project Execution: Outputs 4.5.3 Monitor and Control Project Work: Outputs 5.2.3 Scope Definition: Outputs 6.1.3 Activity Definition: Outputs 6.2.3 Activity Sequencing: Outputs 6.3.3 Activity Resource Estimating: Outputs 6.5.3 Schedule Development: Outputs 6.6.3 Schedule Control: Outputs
6	x.n.1.3.1.1	Requested		
6	x.n.1.3.1.2	Approved		4.6.3 Integrated Change Control: Outputs (4.6.3.1)
6	x.n.1.3.1.3	Implemented		4.4.3 Direct and Manage Project Execution: Outputs (4.4.3.3) 4.5.3 Monitor and Control Project Work: Outputs 5.2.3 Scope Definition: Outputs 6.1.3 Activity Definition: Outputs 6.2.3 Activity Sequencing: Outputs 6.3.3 Activity Resource Estimating: Outputs 6.5.3 Schedule Development: Outputs
6	x.n.1.3.1.4	Rejected		4.6.3 Integrated Change Control: Outputs (4.6.3.2)
5	x.n.1.3.2	Issues	A point or matter in question or in dispute, or a point or matter that is not settled and is under discussion, or over which there are opposing views or disagreements.	
6	x.n.1.3.2.1	Raised		
6	x.n.1.3.2.2	Resolved		

Work Breakdown Structure			WBS Dictionary	
WBS Level	WBS Code	WBS Element Title	Description	PMBOK® Guide References (Sample)
5	x.n.1.3.3	Corrective Actions	Documented direction for executing the project work to bring expected future performance of the project work in line with the project management plan.	
6	x.n.1.3.3.1	Recommended		4.5.3 Monitor and Control Project Work: Outputs 5.4.3 Scope Verification: Outputs 6.6.3 Schedule Control: Outputs
6	x.n.1.3.3.2	Approved		4.6.3 Integrated Change Control: Outputs
6	x.n.1.3.3.3	Implemented		4.4.3 Direct and Manage Project Execution: Outputs
5	x.n.1.3.4	Preventive Actions	Documented direction to perform an activity that can reduce the probability of negative consequences associated with project risks.	
6	x.n.1.3.4.1	Recommended		4.5.3 Monitor and Control Project Work: Outputs
6	x.n.1.3.4.2	Approved		4.6.3 Integrated Change Control: Outputs
6	x.n.1.3.4.3	Implemented		4.4.3 Direct and Manage Project Execution: Outputs
5	x.n.1.3.5	Defect Repairs	Formally documented identification of a defect in a project component with a recommendation to either repair the defect or completely replace the component.	
6	x.n.1.3.5.1	Recommended		4.5.3 Monitor and Control Project Work: Outputs
6	x.n.1.3.5.2	Approved		4.6.3 Integrated Change Control: Outputs
6	x.n.1.3.5.3	Implemented		4.4.3 Direct and Manage Project Execution: Outputs
6	x.n.1.3.5.4	Validated		4.6.3 Integrated Change Control: Outputs
4	x.n.1.4	Formal Acceptance Documentation	Formal acceptance and handover of the final product, service, or result that the project was authorized to produce.	4.7.3 Close Project: Outputs

Work Breakdown Structure			WBS Dictionary	
WBS Level	WBS Code	WBS Element Title	Description	PMBOK® Guide References (Sample)
4	x.n.1.5	Project Closure Documents	Formal documentation indicating completion of the project and transfer of the completed project deliverables.	4.7.3 Close Project: Outputs
3	x.n.2	Scope	The sum of the products, services, and results to be provided as a project.	
4	x.n.2.1	Preliminary Project Scope Statement	The Preliminary Project Scope Statement is the definition of the project -- what needs to be accomplished. The Development Project Scope process addresses and documents the characteristics and boundaries of the project and its associated products and services, as well as the methods of acceptance and control.	1.4.3 Section III: The Project Management Knowledge Areas 3.2.1.2 Develop Preliminary Project Scope Statement Table 3.2. Develop Preliminary Project Scope: Inputs and Outputs 4.2.3 Develop Preliminary Project Scope Statement: Outputs 4.6.3 Integrated Change Control: Outputs
4	x.n.2.2	Project Scope Statement	Describes in detail the project's deliverables and the work required to create those deliverables. The scope statement provides a documented basis for making future project decisions and for confirming or developing common understanding of project scope among the stakeholders. As the project progresses, the scope statement may need to be revised or refined to reflect approved changes to the scope of the project.	3.2.2.3 Scope Definition Table 3-6. Create WBS: Inputs and Outputs 3.2.3 Executing Process Group 3.3 Process Interactions 5.2.3 Scope Definition: Outputs 5.3.3 Create WBS: Outputs 5.5.3 Scope Control: Outputs
4	x.n.2.3	Work Breakdown Structure	A deliverable-oriented grouping of project elements that organizes and defines the total work scope of the project. Each descending level represents an increasingly detailed definition of the project work.	1.4.3 Section III: The Project Management Knowledge Areas 3.2.2.4 Create WBS Table 3-6. Create WBS: Inputs and Outputs 5.3.3 Create WBS: Outputs 5.5.3 Scope Control: Outputs

Work Breakdown Structure			WBS Dictionary	
WBS Level	WBS Code	WBS Element Title	Description	PMBOK® Guide References (Sample)
4	x.n.2.4	WBS Dictionary	A dictionary that describes each component in the Work Breakdown Structure (WBS). For each WBS component, the WBS dictionary includes a brief definition of the scope or statement of work (defined deliverables), a list of associated activities and a list of milestones. Other information may include: responsible organization, start and end date, resolutions requirements, an estimate of cost, charge number, contract information, quality requirements, and technical references to facilitate performance of the work.	Table 3-34. Scope Control: Inputs and Outputs 5.3.3 Create WBS: Outputs 5.5.3 Scope Control: Outputs
4	x.n.2.5	Contract Statement of Work	A narrative description of products, services, or results to be supplied under contract.	
4	x.n.2.6	Scope Baseline	The approved time-phased plan (for a project, a Work Breakdown Structure component, a work package, or a scheduled activity), plus or minus approved project scope, cost, schedule, and technical changes.	
4	x.n.2.7	Product Scope Statement	A statement of the features and functions that characterize a product, service, or result.	
3	x.n.3	Schedule	The planned dates for performing scheduled activities and the planned dates for meeting scheduled milestones.	
4	x.n.3.1	Activity List	List includes all scheduled activities that are planned to be performed on the project.	6.1.3 Activity Definition: Outputs 6.2.3 Activity Sequencing: Outputs 6.6.3 Schedule Control: Outputs

Work Breakdown Structure			WBS Dictionary	
WBS Level	WBS Code	WBS Element Title	Description	PMBOK® Guide References (Sample)
4	x.n.3.2	Activity Attributes	A compiled list of extended attributes as defined in the activity list.	6.1.3 Activity Definition: Outputs 6.2.3 Activity Sequencing: Outputs 6.3.3 Activity Resource Estimating: Outputs 6.4.3 Activity Duration Estimating: Outputs 6.5.3 Schedule Development: Outputs 6.6.3 Schedule Control: Outputs
4	x.n.3.3	Milestone List	A list of all scheduled milestones and an indicator as to whether the milestone is mandatory or optional.	6.1.3 Activity Definition: Outputs
4	x.n.3.4	Activity Duration Estimates	Quantitative assessments of the likely number of work periods needed to complete a scheduled activity.	6.4.3 Activity Duration Estimating: Outputs
4	x.n.3.5	Activity Resource Requirements	Identification and description of the types and quantities of resources needed to perform identified work.	6.3.3 Activity Resource Estimating: Outputs 6.5.3 Schedule Development: Outputs 7.1.3 Cost Estimating: Outputs 9.1.1 Human Resource Planning: Inputs
4	x.n.3.6	Resource Calendars	A composite calendar delineating working and non-working days for the duration of the project.	6.3.3 Activity Resource Estimating: Outputs 7.2.1 Cost Budgeting: Inputs
4	x.n.3.7	Project Calendar	A calendar of working days or shifts that establish the dates on which scheduled activities are worked and non-working days that determine the dates on which scheduled activities are idle.	6.5.3 Schedule Development: Outputs
4	x.n.3.8	Project Schedule Network Diagram	Network diagram that graphically indicates dependencies.	6.2.3 Activity Sequencing: Outputs
4	x.n.3.9	Schedule Model Data	Supporting data for the project schedule.	6.5.3 Schedule Development: Outputs 6.6.3 Schedule Control: Outputs
4	x.n.3.10	Project Schedule	Typically, a graphical plan with scheduled start and end dates for each activity.	6.5.3 Schedule Development: Outputs

Work Breakdown Structure			WBS Dictionary	
WBS Level	WBS Code	WBS Element Title	Description	PMBOK® Guide References (Sample)
4	x.n.3.11	Scope Baseline (Note that 6.5.3 and 6.6.3 refer to a Schedule Baseline.)	Approved detailed project scope statement and its associated WBS and WBS dictionary.	5.3.3 Create WBS: Outputs 5.5.3 Scope Control: Outputs 6.5.3 Schedule Development: Outputs 6.6.3 Schedule Control: Outputs
3	x.n.4	Cost	The monetary value or price required to perform and complete the activity or component, or to produce the component. See PMBOK® Guide for specific "Cost" definition.	
4	x.n.4.1	Activity Cost Estimates & Supporting Detail	A quantitative assessment of the likely cost of the resources required to complete schedule activities.	7.1.3 Cost Estimating: Outputs (7.1.3.1) 7.1.3 Cost Estimating: Outputs (7.1.3.2) 7.2.1 Cost Budgeting: Inputs 7.2.2 Cost Budgeting: Tools and Techniques 7.3.3 Cost Control: Outputs
4	x.n.4.2	Project Funding Requirements	Total and periodic are derived from cost baseline...	7.2.3 Cost Budgeting: Outputs 7.3.1 Cost Control: Inputs
4	x.n.4.3	Project Budget	The approved estimate for the project or any Work Breakdown Structure component or any schedule activity. See PMBOK® Guide for specific "Budget" definition.	
4	x.n.4.4	Cost Baseline	A time-phased budget that is used as a basis against which to measure, monitor, and control overall cost performance on the project.	7.2.3 Cost Budgeting: Outputs
3	x.n.5	Quality	The degree to which a set of inherent characteristics fulfills requirements.	
4	x.n.5.1	Quality Metrics	A metric is an operational definition that describes, in very specific terms, what something is and how the quality control process measures it.	8.1.3 Quality Planning: Outputs 8.2.1 Perform Quality Assurance: Inputs 8.3.1 Perform Quality Control: Inputs

Work Breakdown Structure			WBS Dictionary	
WBS Level	WBS Code	WBS Element Title	Description	PMBOK® Guide References (Sample)
4	x.n.5.2	Quality Checklists (Note that 8.2.1 refers to Approved Change Requests.)	A checklist is a structured tool, usually component-specific, used to verify that a set of required steps has been performed. Quality checklists are used in the quality control process.	8.1.3 Quality Planning: Outputs 8.2.1 Perform Quality Assurance: Inputs 8.3.1 Perform Quality Control: Inputs
4	x.n.5.3	Quality Baseline	Records the quality objectives of the project.	8.1.3 Quality Planning: Outputs 8.3.3 Perform Quality Control: Outputs
3	x.n.6	Human Resources	Documentation and other deliverables required for organization and management of the project team.	
4	x.n.6.1	Project Organization	Documentation and other deliverables that describe interrelationships among project team members or organizational units.	
4	x.n.6.2	Project Staffing		
4	x.n.6.3	Team Performance Assessment		
3	x.n.7	Communications	Communications deliverables are involved in the generation, collection, distribution, storage, retrieval, and ultimate disposition of project information.	
4	x.n.7.1	Project Reports	Formal and informal project reports detail project status, and include lessons learned, issues logs, project closure reports, and outputs from other Knowledge Areas.	
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Work Breakdown Structure			WBS Dictionary	
WBS Level	WBS Code	WBS Element Title	Description	PMBOK® Guide References (Sample)
4	x.n.7.2	Performance Measurement Baseline	An approved plan for the project work against which project execution is compared, and deviations are measured for management control. The performance measurement baseline typically integrates scope, schedule, and cost parameters, of a project, but may also include technical and quality parameters.	
4				4.4.3.7, p. 94; 7.3.1.4
4				6.6.3.3 p 155 (Time); 7.3.3.3
4				7.3.1.3
4	x.n.7.3	Project Procedures	Formal and informal documents that describe and codify the actions and standards that govern the processes, practices, and methods applicable to the project.	
4	x.n.7.3.1	Administrative Closure Procedure		4.7.3.1 p 101
4	x.n.7.3.2	Contract Closure Procedure		4.7.3.2 p 102
4	x.n.7.3.3	Issues Management Procedure		
4	x.n.7.3.4	Defect Management Procedure		
4	x.n.7.3.5	Change Control Procedure		
4	x.n.7.3.6	Risk Control Procedures		
4	x.n.7.3.7	Quality Procedures		
4	x.n.7.3.8	Financial Controls Procedures		
4	x.n.7.3.9	Contract Management Procedures		
4	x.n.7.3.10	Configuration Management Procedures		
4	x.n.7.3.11	Process Improvement Plan	Is a subsidiary of the project management plan; details the steps for analyzing processes that will facilitate the identification of waste and non-value added activity, thus increasing customer value.	8.1.3.4; 8.2.1.3
4	x.n.7.4	Other Communications Deliverables	Formal and informal documents, records, and other information deliverables required by the project and not specifically included elsewhere.	

Work Breakdown Structure			WBS Dictionary	
WBS Level	WBS Code	WBS Element Title	Description	PMBOK® Guide References (Sample)
4	x.n.7.4.1	Communications Requirements Analysis		
4	x.n.7.4.2	Project Presentations		
4	x.n.7.4.3	Lessons Learned		
4	x.n.7.4.4	Glossary of Common Terminology		
4	x.n.7.4.5	Team Operating Agreement (Norms)		
4	x.n.7.4.6	Decision Making Methodology		
3	x.n.8	Risk	Tools, reports, analyses, documents, standards, procedures, and other deliverables required to develop and execute the project risk management plan.	
4	x.n.8.1	Risk Register		
4	x.n.8.2	Risk Related Contractual Agreements		
4	x.n.8.3	Risk Breakdown Structure	Hierarchical depiction of risks by category.	5.3.3 Create WBS: Outputs
4	x.n.8.4	Probability-Impact Matrix		
4	x.n.8.5	Stakeholders' Risk Tolerance Analysis		
4	x.n.8.6	Risk identification Checklist		
4	x.n.8.7	Assumptions Analysis		
4	x.n.8.8	Risk Diagrams (Cause and Effect, Fishbone, Influence)		
4	x.n.8.9	Root Cause Analysis		
4	x.n.8.10	Risk Data Quality Assessment		
4	x.n.8.11	Monte Carlo Simulation/Analysis		
4	x.n.8.12	Sensitivity Analysis		
4	x.n.8.13	Expected Monetary Value (EMV) Analysis		
4	x.n.8.14	Decision Tree Analysis		
4	x.n.8.15	Probabilistic Analysis		
4	x.n.8.16	Prioritized List of Risks (Qualitative and Quantitative)		
4	x.n.8.17	Risk Audits		
4	x.n.8.18	Reserve Analysis		

Work Breakdown Structure			WBS Dictionary	
WBS Level	WBS Code	WBS Element Title	Description	PMBOK® Guide References (Sample)
3	x.n.9	Procurement	Documents, reports, analyses, standards, procedures, and other deliverables required to develop and execute the project procurement management plan, including those needed for the acquisition of products, services, or results needed from outside the project team, and those required for administering contracts issued by outside organizations and administering contractual obligations placed on the project team.	
4	x.n.9.1	Make or Buy Decisions		
4	x.n.9.2	Contract/Procurement Policies		
4	x.n.9.3	Procurement Documents		
4	x.n.9.4	Preferred Sellers list		
4	x.n.9.5	Qualified Sellers List		
4	x.n.9.6	Evaluation Criteria		
4	x.n.9.7	Bidder's Conference		
4	x.n.9.8	Advertising		
4	x.n.9.9	Procurement Documents Package		
4	x.n.9.10	Proposals		
4	x.n.9.11	Selected Sellers		
4	x.n.9.12	Contract Documentation		
4	x.n.9.13	Closed Contracts		
4	x.n.9.14	Terms and Conditions		
4	x.n.9.15	Contract Statement of Work (SOW)		
4	x.n.9.16	Seller Performance Evaluation Doc. - Vendor Perform. Reports		
4	x.n.9.17	Seller Performance Evaluation Doc. - Vendor Perform. Reviews		
4	x.n.9.18	Audits / References / Inspections		
4	x.n.9.19	Screening System		
4	x.n.9.20	Negotiations		
4	x.n.9.21	Claims/Disputes/Appeals		
4	x.n.9.22	Procurement Audit		
4	x.n.9.23	Contract File		

Work Breakdown Structure			WBS Dictionary	
WBS Level	WBS Code	WBS Element Title	Description	<i>PMBOK® Guide</i> References (Sample)
4	x.n.9.24	Deliverable Acceptance		