

Project Scope Management

Asadullah Khan

ABSTRACT: Managing the scope of a project is the most important function of a project manager. The project may be in any sphere of industrial or non-industrial activity, manufacturing or service environment, private or public enterprise, government or non-government undertaking. Effective scope management of a project also ensures the successful management of other key project management areas, including time, cost, and quality. Project scope management can be further sub-divided into its components which include project initiation, scope planning, scope definition, scope verification, and scope change control.

KEY WORDS: Project scope management, planning, verification, and work breakdown structure

Managing the scope of a project is the most important function of a project manager. The project may be in any sphere of industrial or non-industrial activity, manufacturing or service environment, private or public enterprise, government or non-government undertaking. Effective scope management of a project also ensures the successful management of other key project management areas, including time, cost, and quality.

Project scope management can be further sub-divided into its components which include the following.

- project initiation;
- scope planning;
- scope definition;
- scope verification; and
- scope change control.

At the heart of all project scope components is the work breakdown structure (WBS). All components of scope management interact with each other through the WBS (see figure 1). A WBS, as the name suggests, is a hierarchical breakdown of the project into its constituent elements.

Having a detailed WBS means having a large number of levels. This allows for more accurate management of the project. However, detailed WBS also requires devoting more resources to gathering and compiling information for reporting purposes. A decent balance must be achieved between project reporting requirements and the desired degree of control. Some examples of WBS are given in this article.

Effective management of scope has a positive effect on other project management areas too. These can include procurement management, contracts management, risk management, and human resource management.

The five components of project scope management are presented in this article with WBS at the core.

PROJECT INITIATION

Projects are initiated in order to satisfy a business need. The business need may arise because of a market demand situation. For example, a company may decide to undertake an expansion project for existing facilities in order to catch up with increasing market demand.

A business need may arise to satisfy a new environmental regulation that requires companies to treat and purify effluent streams. Projects undertaken to improve service factors of a customer service company is another example justifying a business need to undertake a project. Figure 2 shows typical business needs that may trigger a project.

Once a business need is identified and aligned with a company's strategic objectives, a project may be initiated subject to satisfaction of feasibility criteria. Usually a mini project is authorized and resources assigned to carry out a feasibility analysis before the full-scale project is launched. The project manager is the first full-time resource assigned to the project. Although a discussion on project manager competencies is outside the dimensions of this article, a project manager must be able to display a high level of both management and leadership qualities.

Project feasibility analysis is comprised of technical, economic, and financial aspects.

- **Technical feasibility** explores the availability of technological know-how; competency of management and operations teams; availability of land, infrastructure, utilities, etc.
- **Economic feasibility** evaluates the benefit-cost ratios of different technological options available. It also evaluates rates of return for the project over its anticipated lifetime. And,

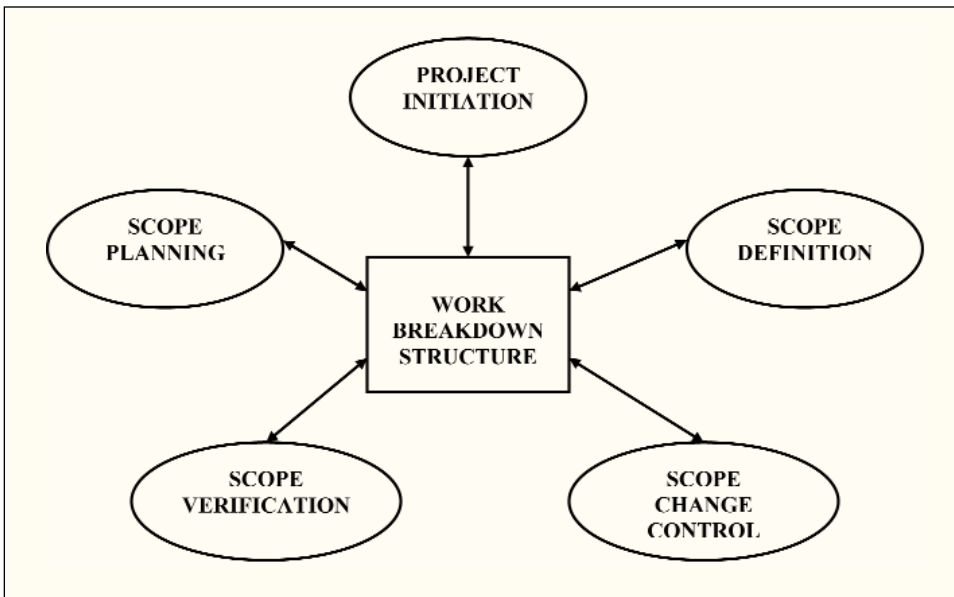


Figure 1 – An Example of How All Components of Scope Management Interact with Each Other Through a WBS

- **Financial feasibility** deals with availability of necessary funds, cost of borrowing money based on credit rating of owner organization, etc.

Table 1 provides information on each of the above mentioned feasibility aspects.

Key Output

Detailed feasibility analysis is the most important output from the initiation phase of scope management. This allows management to give the go-ahead for project to proceed or to shelve it.

Scope Planning

Scope planning is all about developing a summary and intermediate level WBS. Development of project scope is not detailed enough at this stage for creation of a comprehensive WBS.

After the project has been approved and allowed to proceed, the project manager gets down to work with his team for the development of project scope. At this stage it is useful to work with knowledge of project cost, schedule, and key quality parameters. However, like most other project management areas, project scope management is an iterative process. Information received over time is constantly fed back into the system, making it a truly iterative process. Progressive detailing and rolling wave planning are other terms that are synonymous with the scope planning phase.

An example of summary and intermediate level WBS is given in figure 3 with key deliverables identified. Note that detailed feasibility has already been completed; all items to be considered in a detailed feasibility analysis have been judged to be feasible.

Organizing the work (project) in a deliverable-oriented form allows the project management team to focus on each of the components and add details progressively. It also allows formation of a project organization to take care of each component of the project.

However, this is not the only way of organizing a WBS for this type of project. Figure 4 illustrates another method of preparing a WBS for the same project.

The example presented in figure 3 lends itself toward a balanced matrix approach (project + functional). Most organizations today are of the balanced matrix type as opposed to pure project organizations. The example presented in figure 4 is more likely the work of a pure project organization. Both approaches are valid; it is just a matter of the way in which the owner organization operates.

Key Outputs

- Summary and intermediate level work breakdown structure (WBS);
- design basis memorandum (DBM);
- invitation to bid (ITB); and
- award basic engineering package (BEP) contract.

Scope Definition

At the point of scope definition, the framework for project scope has been put in place as part of the scope planning process. As noted earlier, the following activities have already been carried out.

- project manager assigned.
- project management team formed.
- feasibility completed.
- summary level WBS created.
- project budget, schedule, key product parameters outlined.
- design basis memorandum.
- invitation to bid.

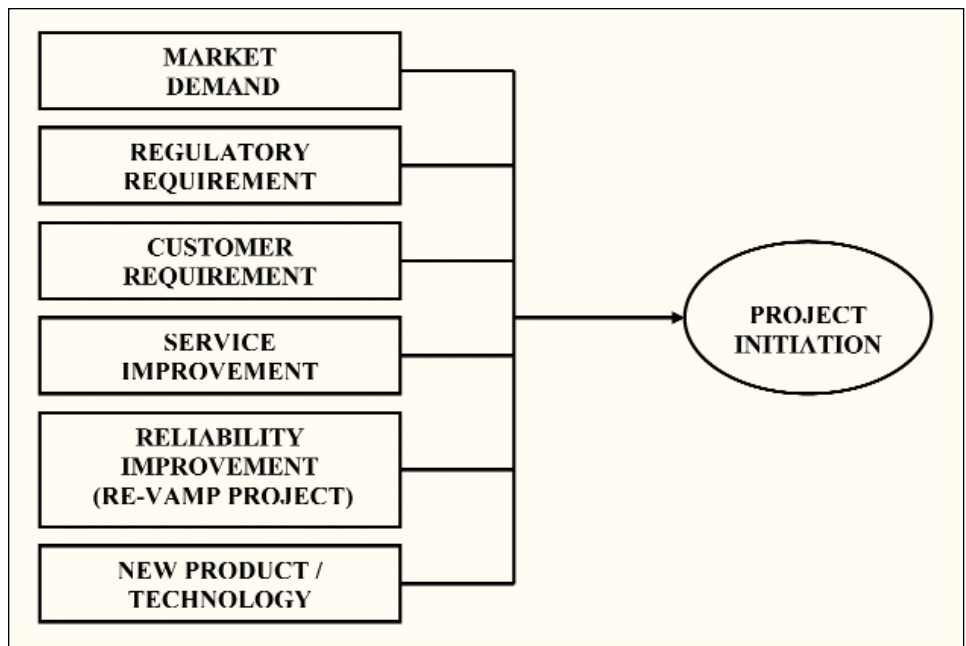


Figure 2 – Typical Business Needs that May Trigger a Project

Technical Feasibility	Economic Feasibility	Financial Feasibility
<ul style="list-style-type: none"> • availability of technology; • previous experience of similar projects; • competency of management team; • competency of operations team; • availability of raw material, feedstock; • infrastructure; • utilities; and • suitable land. 	<ul style="list-style-type: none"> • benefit-cost ratios; • economic models; • linear and non-linear programming techniques; • decision trees; and • expert Judgment. 	<ul style="list-style-type: none"> • availability of necessary funds; • cost of borrowing money; and • credit rating of owner organization.

Table 1 – Project Feasibility is Comprised of Technical, Economic, and Financial Aspects

- BEP contract award.

It is time to add details to the framework created. The WBS needs to be expanded to include details down to the work package level. Selection of technology is one of the factors to be considered for a feasibility analysis. Subsequently in the scope planning phase, a design basis memorandum (DBM) is prepared. The DBM provides essential information on required flow sheet rates (capacity in tons/year); key product characteristics, for example, composition, purity, or conformance to a particular standard; plant site data relating to location, weather, humidity; and available infrastructure and utilities.

DBM is then used to invite bids from prospective bidders. Invitation to bid (ITB) is the activity of inviting bids from a list of selected and short-listed technology providers (also known as process licensors). Once a process licensor has been selected as a result of the bidding process, work on the scope definition phase can begin in earnest.

Preparation of a basic engineering package (BEP) marks the beginning of the scope definition phase. A fully staffed project management team has been assembled to work in coordination with process licensor on the basic engineering package. Scope issues become progressively clarified as buyer (owner organization) and seller (process licensor) work together. Responsibility of filling in the details for WBS still rest with the owner, project manager, and his/her team.

It must also be understood that the five components of project scope management are not discrete phases. Often they overlap and proceed concurrently. In some cases, based on magnitude of scope, some of the phases may be merged together. WBS represents scope of the project. Everything included in the WBS is part of project

scope. Anything not shown clearly in a management reserve and contingency WBS is out of project scope, along with any implied activities.

Many a project manager has come to grief for not preparing a comprehensive enough WBS. In order to mitigate cost risks there are two types of emergency funds allocated as part of a project budget:

- **Management reserves** are used for unexpected changes to project scope, for example a mandatory new regulatory requirement.
- **Contingency funds** are used for expected additional work that cannot

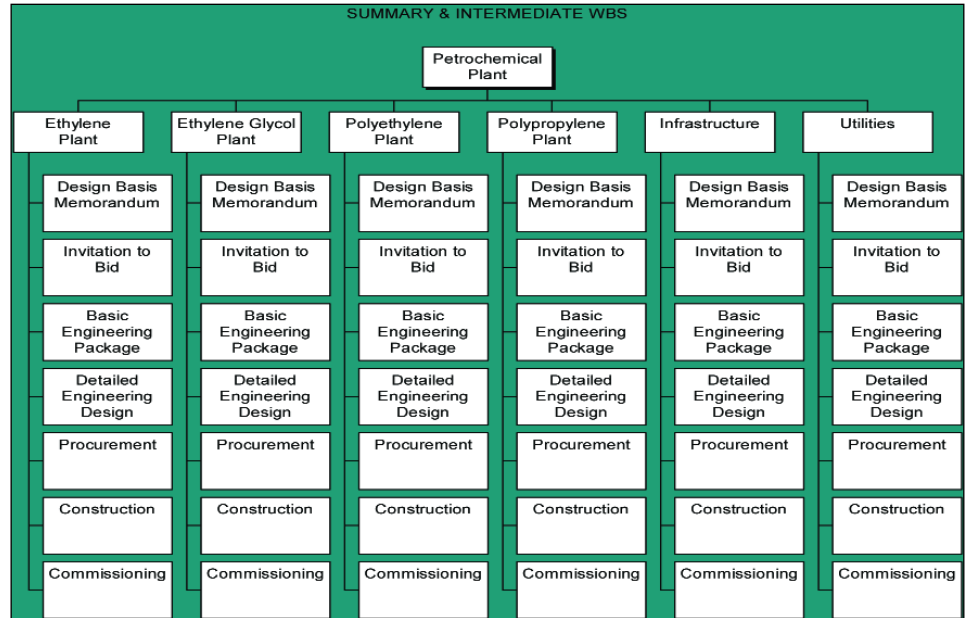


Figure 3 — A Summary and Intermediate Level WBS

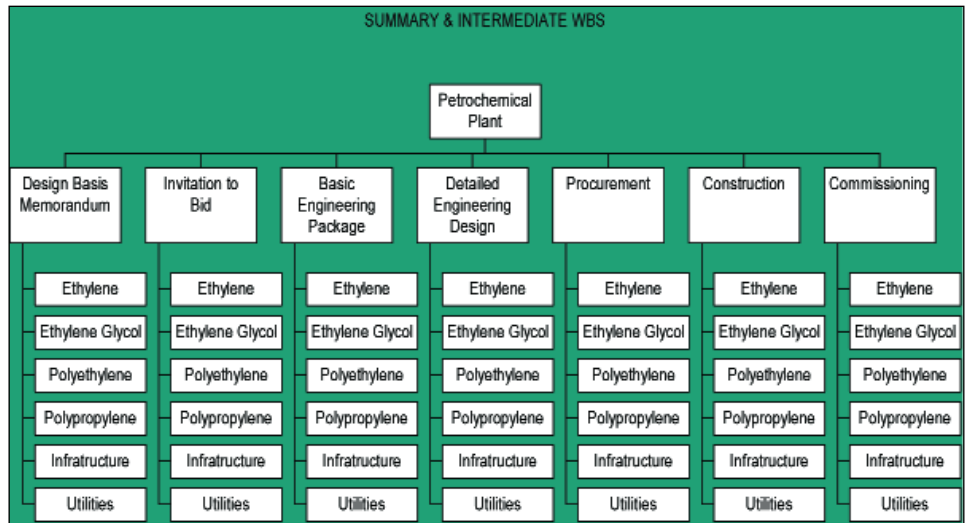


Figure 4 — Example of a Pure Project Organization WBS

Types of Change	Reasons for Change	Nature of Change
<ul style="list-style-type: none"> • design specification change; • process design development; • project execution change; • external budget transfer; • estimate adjustment; • field change; and • commissioning change. 	<ul style="list-style-type: none"> • correct deficiency to meet safety, health or environmental regulations; • correct deficiency to meet operational requirements; • correct deficiency in cost estimate; and • adjust budget to reflect changed execution basis. 	<ul style="list-style-type: none"> • discretionary; and • non-discretionary.

Table 2 — A General Listing of the Types, Reasons, and Nature of Changes

be accurately quantified, for example the amount of re-work required in completing engineering design or opting for more expensive but expeditious airfreight of critical items instead of sea freight.

A typical WBS developed during the scope definition phase would look something like what is shown in figure 5. For the sake of brevity, one part of the summary and intermediate WBS from figure 3 is expanded to show detailed activities.

Key Outputs

- basic engineering package (BEP);
- award engineering, procurement and construction (EPC) contract. Detailed engineering design will be accomplished as part of the EPC contract. And,
- detailed engineering design (DED).

Scope Verification

Scope verification is intricately connected to the previous two processes, scope planning and scope definition. However, the distinguishing feature of this process is the feed back loop it provides in verifying the contents of all work done thus far (see figure 6).

Scope verification involves checking all design and engineering deliverables required as part of scope planning and definition phases. It is important to note that the verification process does not have to wait until after completion of its predecessors, scope planning and definition.

It is a continuous process that starts almost concurrently with its predecessors.

Verification that work has indeed been carried out in accordance with applicable regulations and design documents is also required for progress measurement.

For making progress payments to the contractor, it is first required of the project management team to verify the contents of each progress payment invoice submitted by the contractor.

Earned value management is a technique frequently used for measuring progress of a project. Earned value management evaluates several indices to measure the cost and schedule progress of the project. Basically, it is the comparison of the actual verified work performed against the scheduled work that was

planned to be performed at the given time interval (schedule performance).

Moreover, it also compares the actual cost incurred at the given time interval versus the budgeted cost (cost performance). Schedule and cost performance of a project at regular intervals enable the project management team to forecast any schedule or cost overruns.

Application of earned value management techniques tell us that under par performance on schedule and cost would soon incur schedule and cost overruns that are irreversible.

Relationships of the five scope management processes are shown in figure 6.

Key Outputs

- procurement; and
- construction

Scope Change Control

Practitioners of project management realize that scope change is an inevitable reality for any project. Management of scope change is of vital importance because scope creep can assume

horrendous proportions and may even force project cancellation.

Scope creep is a term used to describe unauthorized scope changes. Unauthorized changes may creep into project scope as a result of verbal instructions, e-mail instructions, written instructions that have been issued without realizing the magnitude of change, etc.

An effective scope change control mechanism must be put in place as early as the start of the scope planning phase. It is important to classify types of scope change requests and the reason for the change. Moreover, it should be made clear whether change is discretionary or non-discretionary (essential).

Overall the impact of scope change on schedule, cost, and quality should be evaluated. A general listing of the types, reasons, and nature of changes is presented in table 2.

Key Outputs

- acceptance tests; and
- commissioning.

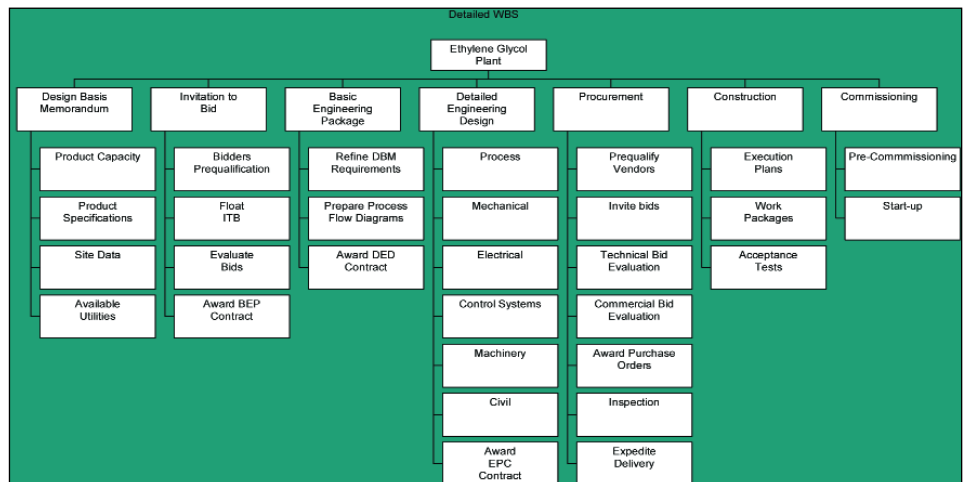


Figure 5 — Example of a Typical WBS Developed During Scope Definition

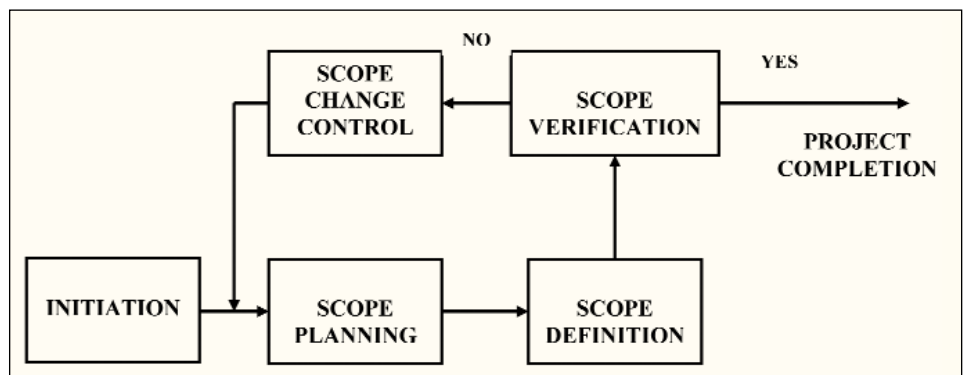


Figure 6 — Example of a Scope Verification Feedback Loop

Successful management of scope in essence defines the success of a project for a project manager and the project management team. Changes in scope during the course of a project are inevitable and nothing to be afraid of. Key stakeholders should be kept well informed of scope changes that have an effect on schedule, cost, and quality. Stakeholder buy-in can only be achieved by the dissemination of correct information in an expeditious manner. ♦

ABOUT THE AUTHOR

Asadullah Khan is a senior project engineer with Saudi Basic Industries Corporation (SABIC), Al-Jubail, Saudi Arabia. He holds a MS degree in manufacturing systems engineering from Oklahoma State University, and a BS degree in mechanical engineering from N.E.D. University of Engineering and Technology, Pakistan. He has 13 years of experience in project engineering and management for the petrochemical industry. He can be contacted by sending e-mail to: asadullah.khan@us.abb.com.

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