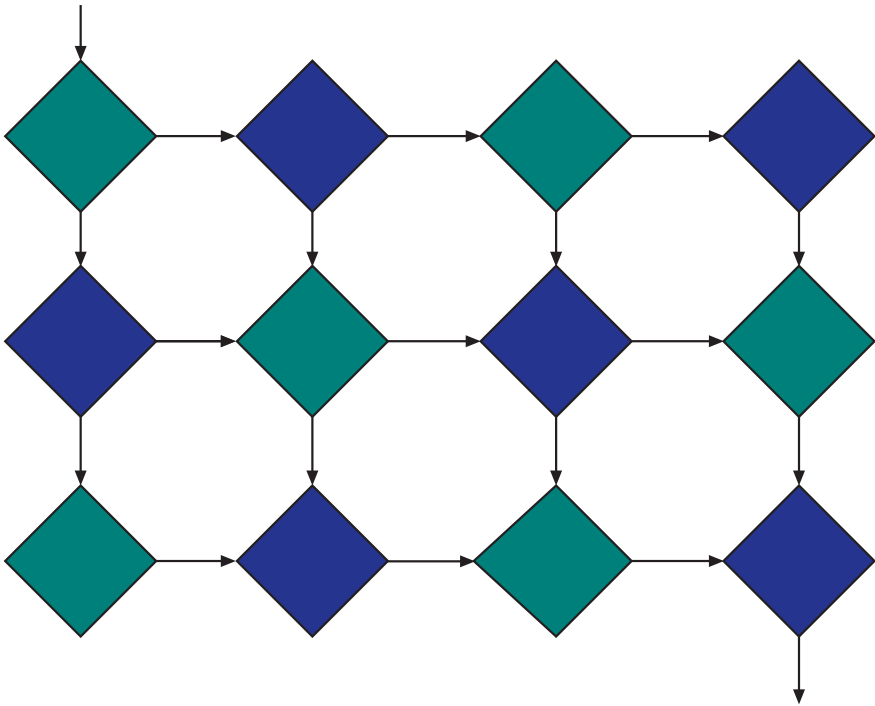




Handbook

Owner/Contractor Work Structure Process



Owner/Contractor Work Structure Process Handbook

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Prepared by

Construction Industry Institute

Owner/Contractor Work Structure Process Research Team

CII Implementation Resource 111-2

April 1997

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Executive Summary

Capital projects and how owner organizations are structured to manage and execute the projects are changing dramatically, driven primarily by competitiveness in the global market. The changes, particularly in the way work relationships are structured between owners and contractors, are often reactions instead of well thought out processes.

For example, misalignment is evident regarding the competencies needed to support the engineer-procure-construct (EPC) process. Disagreements occur regarding where those competencies should reside. In particular, there is no known process or strategy in the industry that can be used to strategically align owner and contractor resources.

The CII Owner/Contractor Work Structure Research Team has developed a process that can solve these alignment problems. The purpose of this handbook is to describe the process the research team developed for determining an effective owner/contractor work structure. The user of this handbook should first review the introductory material to gain an understanding of the background and key points to consider prior to implementation. Next, the process model, including key terms and their definitions, should be fully studied and understood. The user can then apply the alignment process at either the corporate or project levels, as each process is described in detail through stand-alone chapters. Other useful information that may help the user implement the owner/contractor work structure process is provided in the appendices.

Chapter 1: Introduction

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1.1 Background

Owner and contractor companies are experiencing organizational change in efforts to maintain or increase their market share in a global economy. This change is driven by attempts to reduce fixed or overhead costs, decrease workloads due to smaller annual capital program expenditures, and improve operational efficiency. Organizational change is frequently accompanied by “downsizing,” or a reduction in staff size and competency. Downsizing has had a particular influence on organizations within owner companies that develop and execute capital projects. Owners are restructuring their central engineering organizations, shifting project responsibilities to business units or operating facilities, or outsourcing more work to contractors.

Organizational change thus may leave owners inadequately structured to develop and execute capital projects. Many owner personnel continue to perform the same number of project functions despite reductions in resources. Senior level managers and professionals are retiring, taking their knowledge and experience with them. Personnel who remain may not have the skills, experience, or decision-making authority necessary to perform project work effectively. Because of limited resources, owners are reevaluating both the timing and level of their involvement in the project delivery process.

In such an environment, owners have to assess the value that their organizational resources contribute to project development and execution, and also those aspects of projects that have financial and legal implications for their companies. They are rightfully focusing efforts on front-end project development activities that have the greatest influence on project outcomes.

Contractor companies are experiencing similar organizational change. Some contractors are reducing personnel even though workloads are increasing. Changes are being made to reduce fixed costs and to increase competitiveness. Contractors are attempting to adapt to changes in owner approaches to capital project delivery: they are adding project skills that

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owners are reducing or eliminating. Contractors also are adding skills because they are now involved earlier in the project delivery process and in project phases that represent non-traditional work. In addition, owners are requesting new services from contractors because of advances in process, design, and construction technologies.

For capital projects, owners want high quality projects as fast as possible at the lowest possible cost with no harm to workers or the environment. To accomplish this, owners and contractors must form work structures that clearly define the major roles and responsibilities of each participant to avoid gaps, to eliminate duplication of effort, and to share risk appropriately.

Owners need to identify and maintain, and/or have access to, minimum core skills. Contractors need to foster new skills that result from performing activities previously under the domain of owner central engineering. As a consequence, both owners and contractors need a work process to select the best work structure congruent with project type, cost, and objectives considering project delivery approaches, contract types, and organizational relationships.

In response to this need, the following sections describe a work process developed through research that provides a method to create organizational relationships and work structures for the most cost-effective development and execution of capital projects, recognizing today's trend of fewer owner engineering resources. The process can be applied at both a corporate and project level with some modifications.

1.2 Key Points

The research team suggests that the following points be considered when deciding whether or not to apply the corporate and/or project level work structure processes:

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- The process is systematic, flexible, and can be used in many different situations and by different companies (owners and contractors). Different uses will necessitate some modification. Chapter 5 describes several possible alternate applications. The user is encouraged to determine other situations where the process can be implemented.
- Because the process is systematic and structured, each step should be followed in sequence when determining competencies and their sourcing. In this way, the process provides a rationale for evaluating project skills and resources needed. This rationale is captured through documenting results on worksheets used when performing the process.
- The process is an excellent vehicle for discussion when different viewpoints are represented. Users are encourage to include key corporate and project stakeholders when performing all or some process functions.
- The corporate and project level work processes are presented in separate chapters. Each can be applied independently of the other. However, the corporate process should be performed first as it provides the policy framework for competencies and sourcing strategies at the project level. Different people can use these two processes.
- Use of decision flow charts and the layout of the guidebook provide for a easy-to-use format. Key information and examples are also provided to help the user understand different aspects of the process. Users are encouraged to modify the process as required to fit their application and company's mode of operation.

1.3 Overview of the Owner/Contractor Work Structure Handbook

The following chapters of this handbook describe how the work structure process is conducted for both the corporate and project levels. A brief overview of each chapter follows:

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- Chapter 2 presents the model, key terms, and their definitions. Terms may be applied in a slightly different context than their normal use, and are presented in five categories: critical, corporate level, project level, general, and competencies.
- Chapter 3 presents decision flow charts and detailed procedures to implement the corporate work process. A brief overview of the entire owner corporate work structure framework is provided. Next, a process function decision flow chart is shown. A brief narrative description of the main objectives of the process function is given. Each decision flow chart is then shown in sections. Each section is described in terms of a number of steps, decisions, and general information that must be considered when performing the section of the process function flow chart. Information is represented by a different symbol. The meaning of each symbol is explained as follows:

-  Step that must be executed
-  Elements or key issues that must be considered
-  Decision points or questions raised
-  General information provided

These symbols are used consistently throughout this chapter.

- Chapter 4 describes the work structure process for a project level application. The information and layout of this chapter is identical to Chapter 3.
- Chapter 5 introduces alternate applications of the work structure process.

A list of appendices provides the user with a complete decision flow chart, an entire set of worksheets, a comprehensive example application of the work process, examples of competency functions and critical capabilities, references, and the research team membership.

Chapter 2: Process Model, Terms, and Definitions

2.1 Process Modeling Approach

The research team needed a methodology to develop an owner/contractor work structure process. The IDEF0 (*eye-deaf-zero*) technique was chosen as the process modeling tool.

2.1.1 IDEF0 Modeling Technique

IDEF0 is a graphical methodology that helps to formalize a process. This methodology first identifies the primary functions of the process and then represents them in a structured procedural form. Figure 1 shows the basic entity of an IDEF0 model. A function (box) and the interfaces to or from the function are shown as arrows entering or leaving the box. Inputs, or information needed to *perform* the function, are transformed by the function to provide outputs, or information *produced* by the function. Controls consist of information that governs the accomplishment of the function. Mechanisms represent people who perform the function or tools that are used in the performance of the function.

The technique is highly structured and hierarchical in nature. A process modeled using the IDEF0 technique consists of functions that are subdivided into increasing levels of detail. Each function level is a “decomposition” of a higher-level function. For example, a single function may be decomposed

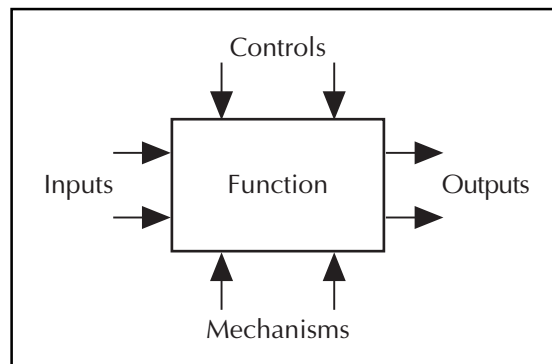


Figure 1. IDEF0 Modeling Entity

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into three subfunctions. Also, at any level, functions can occur concurrently, interactively, and repetitively. This modeling technique captures the flow of information between functions.

Decision flow charts are used to describe details of each function of the work process. This transition from the IDEF0 model to decision flow charts that support the IDEF0 model is shown in Figure 2. As illustrated for the project level model, the work process is comprised of three major functional areas. Each major functional area is decomposed into a specific set of functions, each with inputs, outputs, controls, and mechanisms. At this level, a decision flow chart is used to delineate all the necessary steps, decision points, information, and worksheets needed to perform each function. A series of decision flow charts is created for each function of the owner/contractor work structure process at both the corporate and project levels.

2.1.2 Corporate Level Process

To use the process to determine a *corporate* work structure requires performing two functional areas: **Determine Key Capital Program Competencies (A1)** and **Evaluate Sourcing of Competencies (A2)**. These functions are shown in Figure 3, using the IDEF0 symbology.

The first functional area identifies and defines the competencies needed for an owner's capital program. These competencies are classified as either core or non-core. The second functional area selects appropriate sourcing approaches and work relationships for each competency identified. Both functional areas have underlying functions and decision flow charts that further describe the details of the process, as illustrated in Figure 2.

The process can be performed for a specific business unit or for a corporate central engineering group as a whole or both. A key input into the process, as depicted in Figure 3, is the capital program for the company. The output of this corporate process is a Corporate Work Structure Matrix. This

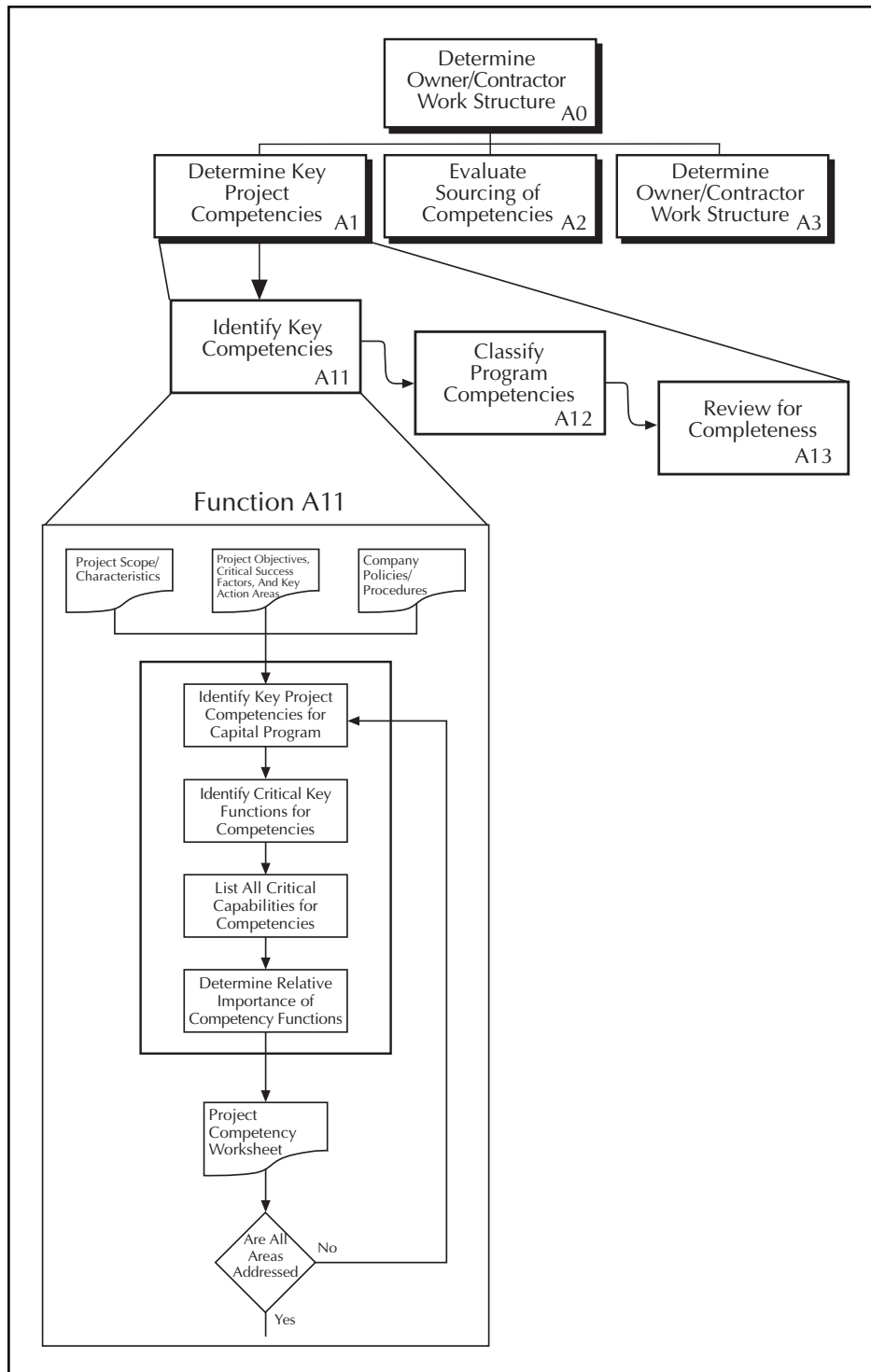


Figure 2. IDEF0 Model and Decision Flow Chart Development Hierarchy

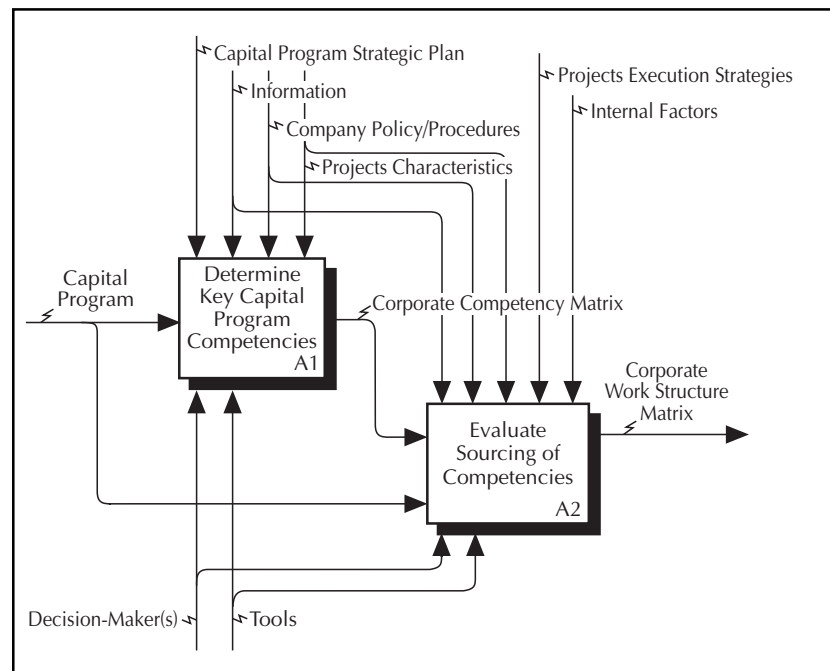


Figure 3. Corporate Work Structure Process

completed matrix should be used for detailed planning of corporate resource requirements and sourcing strategies for capital projects as well as a guide for a specific project work structure.

As shown in Figure 3, functional areas **A1** and **A2** show key information that controls or influences the formation of a Corporate Work Structure. This information includes a capital program strategic plan, project execution strategies, company policies/procedures, internal factors, information, and projects characteristics. Each type of information and its influence on the process are described in more detail through definitions and decision flow charts.

Mechanisms that facilitate performance of the *corporate work structure process functions* are delineated as either decision-maker(s) or tools. Decision-maker(s) may entail one individual or a group of individuals. A decision-maker is defined as person who has the authority to make decisions regarding the commitment of company resources (money, time, or people) for capital projects. This person performs the functions and evaluations of

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the work process. Decision-makers involved in the *corporate process* may include executives such as vice-presidents, general managers, and department managers responsible for capital programs. Tools include worksheets that facilitate the performance of each process function.

2.1.3 Project Level Process

To use the process to determine a *project* work structure requires performing three functional areas: **Determine Key Project Competencies (A1)**, **Evaluate Sourcing of Competencies (A2)** and **Determine Owner/Contractor Work Structure (A3)**. These functions are shown in Figure 4 using IDEF0 symbols. The first functional area identifies and defines the competencies needed for a specific project. These competencies are classified as core or non-core for the project. The second functional area selects the most appropriate sourcing approach and work relationship for each competency identified. The third functional area locates the particular project phase where the work relationship for a competency is needed. All three functional areas have underlying functions and decision flow charts that further describe the details of the process (refer to Figure 2).

The process should be performed early in project development and repeated as required over the project's life. A key input into the process, as depicted in Figure 4, is project scope. The output of this process is a Project Work Structure Matrix. This completed matrix should be used for the detailed planning of roles and responsibilities of individual project team members.

As shown in Figure 4, functional areas A1, A2, and A3 show key information that controls or influences the formation of a Project Work Structure. This information includes project objectives and crucial success factors, company policies/procedures, internal factors, information, and projects characteristics. Each type of information and its influence on the process are described in more detail through definitions and decision flow charts.

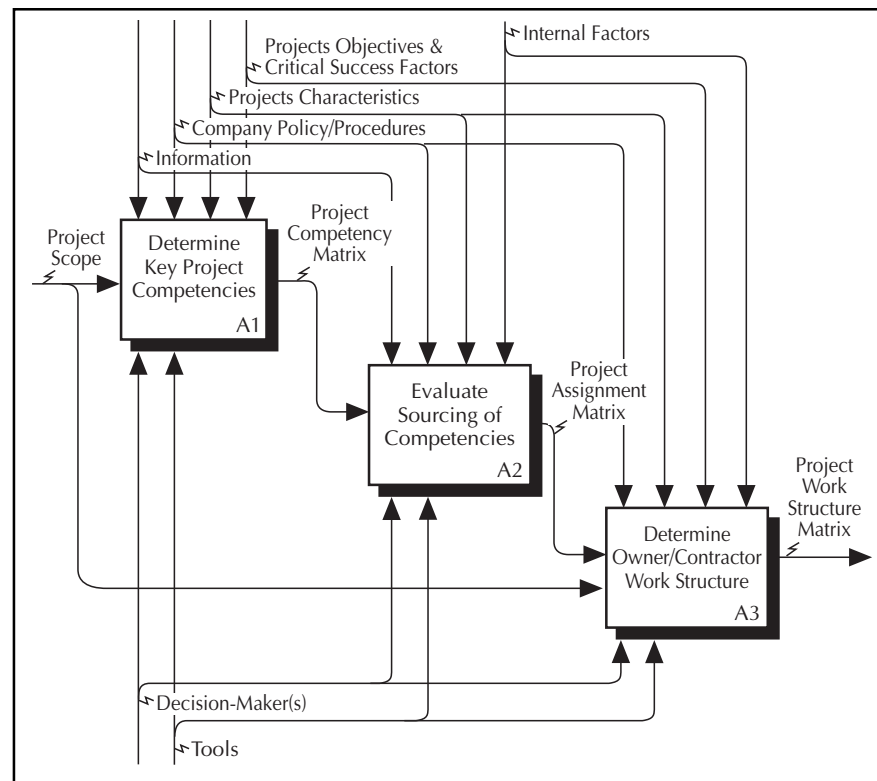


Figure 4. Project Work Structure Process

Mechanisms that facilitate performance of the *project work structure process functions* are delineated as decision-makers or tools. Decision-makers may entail one individual or a group of individuals. A decision-makers is defined as a project person who has the authority to make decisions regarding the commitment of company resources (money, time, or people) for a project. This person performs the functions and evaluations of the work process. Decision-makers involved in the *project process* may include project managers, general project managers, technical managers, and operations managers responsible for project development and execution. Tools include worksheets that facilitate the performance of each process function.

2.2 Critical Terms

Critical terms are fundamental to understanding the work process. These terms are used repeatedly throughout the detailed description of the corporate and project level processes in Chapters 3 and 4. A working knowledge of each term described below is essential to enhance the application of the work processes:

1. **Owner/Contractor Work Structure:** the distribution of roles and responsibilities between primary project participants based on key project competencies.
2. **Project Competency:** a project process that is comprised of functions and associated critical capabilities needed to develop and execute a capital project.
3. **Functions:** steps, activities, and tasks that describe the work involved in performing a competency. Functions convert inputs to outputs.
4. **Critical Capabilities:** the abilities, knowledge, skills, and experience that are necessary to perform competency functions.
5. **Core Competency:** a competency that is critical to having a successful project and must reside with the owner.
6. **Non-Core Competency:** a competency that could either be outsourced to a Contractor(s) or performed in-house if the resources are available.
7. **Work Relationship:** identifies involvement of owner and contractor(s) in performing, leading, and/or providing input with respect to a project competency — Five work relationships have been defined as follows:
 - **OP:** Owner performed. Owner performs all work involved in the competency using their resources according to their work process.

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- **OP/CI:** Owner performed using owner's work process with contractor input. The majority of the work is performed using owner resources. Contractor provides input or acts as a consultant.
- **OL/CP:** Owner led with contractor performing the detailed work using owner's work process. Owner leads by setting guidelines, directing, reviewing and approving work. Contractor performs most of the competency work functions according to the owner's work process.
- **CP/OI:** Contractor performed using contractor's work process with input from the owner. The majority of the work is performed using contractor resources.
- **CP:** Contractor performed. Contractor performs all work involved in the competency using their resources according to their work process. The owner can still supply input and guidance by performing the project management oversight competency.

2.3 Corporate Work Structure Process Terms

The corporate work process presented earlier in Figure 3 contains a number of terms that describe this work process. They should be studied in the context of Figure 3 to gain a basic understanding of the overall corporate work structure process. These terms, defined below, are listed in alphabetical order.

- **Capital Program:** The company's total expenditures for the development, execution, and start-up of capital projects for a given period of time, not including amounts allocated for maintenance. The capital program includes a budget for each type of project required to support corporate businesses.
- **Capital Program Strategic Plan:** Policy guideline that drives the capital program. It establishes the strategic objectives and critical success

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factors for the program. It establishes priorities for projects based on product-to-market factors. This plan is based on the corporation's business plan.

- **Company Capabilities:** Owner resource ability and/or availability to lead, leverage, or perform all or components of a competency.
- **Company Policies & Procedures:** Policies, procedures, or practices, written or understood, that dictate a course of action to include project management procedures and contracting policies.
- **Corporate Competency Matrix:** Final product that documents and classifies (core or non-core) key capital program competencies for the owner's capital program. The Corporate Competency Matrix is developed using a tool described as a Corporate Competency Worksheet. This worksheet is designed to record competencies and the classification of competencies between core and non-core.
- **Corporate Work Structure Matrix:** Final product that documents potential sourcing alternatives by work relationships for all project competencies that are key to the owner's capital program. The Corporate Work Structure Matrix is developed using a tool described as a Corporate Work Structure Worksheet. This worksheet is designed to assist in identifying potential sourcing alternatives by work relationship for all capital program competencies.
- **Decision-maker(s):** Corporate-level person(s) who has the authority to make decisions regarding the commitment of company resources (money, time, or people) for a capital program. This person(s) would perform the functions and evaluations in determining the Corporate Work Structure.
- **Determine Key Capital Program Competencies (A1):** Corporate-level sub-process to identify and document the competencies necessary for successful projects and classify whether competencies are core or non-core for the owner's capital program.

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- **Evaluate Sourcing of Competencies (A2):** Corporate-level sub-process to determine if a competency will be performed using owner resources, contractor resources, or a combination of the two and the work relationship that makes the most appropriate use of owner resources.
- **Information:** Capital projects related information needed to make decisions. This information may come in the form of historical data or information about the contracting community.
- **Internal Factors:** Issues within the owner organization such as critical capabilities, resource availability, and structure of the owner capital project organization, freedom of this organization to manage and execute capital projects, cost of this organization, corporate culture, and company politics. Internal factors include division of capital project responsibilities between central engineering and business units/plants within the owner organization.
- **Project Characteristics:** Categories such as sizes, types, complexity, and location used to describe all projects and conceptual projects within the owner's capital program.
- **Project Execution Strategies:** Potential project organizational relationships, project delivery approaches, and contractual arrangements used to execute projects within the owner's capital program.
- **Tools:** Matrices, worksheets, lists, and examples created to assist in determining the Corporate Work Structure.

2.4 Project Work Structure Process Terms

The project work process presented earlier in Figure 4 contains a number of terms that describe this work process. They should be studied in the context of Figure 4 to gain a basic understanding of the overall project work structure process. These terms are defined below and are listed in alphabetical order.

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- **Company Policies & Procedures:** Policies, procedures, or practices, written or understood, that dictate a course of action to include project management procedures and contracting policies.
- **Decision-maker(s):** Project level person(s) that has the authority to make the decisions regarding the commitment of company resources (money, time, or people) on a project basis. This person(s) would perform the functions and evaluations in determining the Owner/Contractor Project Work Structure.
- **Determine Key Project Competencies (A1):** Sub-process to identify and document the competencies necessary for a successful project and classify whether competencies are core or non-core.
- **Determine Owner/Contractor Work Structure (A3):** Sub-process to determine the sourcing of key project competencies by project phase that considers project organizational relationships, project delivery approaches, and contractual arrangements.
- **Evaluate Sourcing of Competencies (A2):** Sub-process to determine if a competency will be performed using owner resources, contractor resources, or a combination of the two and the work relationship that makes the most appropriate use of owner resources.
- **Information:** Project specific information needed to make decisions. This information may come in the form of historical data or information about a contractor or contractors.
- **Internal Factors:** Issues within the owner organization such as critical capabilities, resource availability, and structure of the owner capital projects' organization, freedom of this organization to manage and execute a project, cost of this organization, corporate culture, and company politics. Internal factors include the division of project responsibilities between central engineering and business units/plants within the owner organization.

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- **Project Assignment Matrix:** Final product that documents the sourcing and work relationship for all project competencies. The Project Assignment Matrix is developed using a tool described as a Project Assignment worksheet. This worksheet is designed to assist in identifying sourcing alternatives of project competencies and describe who will lead and/or perform a project competency, that is, the work relationship.
- **Project Characteristics:** Categories such as size, type, complexity, and location used to describe a specific project.
- **Project Competency Matrix:** Final product that documents and classifies (core or non-core) key project competencies. A Project Competency Matrix is developed using a tool described as a Project Competency Worksheet. This worksheet is designed to record competencies and their classification between core and non-core.
- **Project Objectives/Critical Success Factors:** Project and business needs and goals that define the expectation's of the owner for a project. Critical factors that must be addressed for successful attainment of project objectives based on project scope and characteristics.
- **Project Scope:** The owner's project needs or requirements including such items as facility type and capacity, product mix and characteristics, and design, utility and operating requirements.
- **Project Work Structure Matrix:** Final document of work relationships by project phase between owner(s) and contractor(s) based on key project competencies. The Project Work Structure Matrix is developed using a tool described as a Project Work Structure Worksheet. This worksheet is designed to document the work relationships for key project competencies between owner(s) and contractor(s) by project phase. Typical project phases include Business Needs, Concept, Preliminary Design, Detail Design, Procure Equipment & Materials, Construction, and Start-Up.
- **Tools:** Matrices, worksheets, lists, and examples created to assist in determining the Owner/Contractor Project Work Structure.

2.5 General Terms

General terms are used when describing the details of the corporate and project level work processes in Chapters 3 and 4, respectively. They are often shown on the decision flow charts presented for each process function. They are referred to frequently in the text discussion of steps, information, and decision points depicted on the flow charts. General terms are defined below and are listed in alphabetical order.

- **Alignment Tools:** Worksheets and procedures designed to measure levels of alignment and to maintain alignment through the life of the project and to perform evaluations after project completion.
- **Best Outsourced Competencies:** Competencies that can best be performed by a contractor and if possible should always be outsourced.
- **Business Unit/Plant:** Organization(s) within the owner company that represent the owner's operating and/or production businesses.
- **Central Engineering:** A group within the owner company that is responsible for the development and/or execution of capital projects and is not directly tied to the individual businesses.
- **Competencies Available from Contractor(s):** Competencies that can be performed by a contractor(s) and to the owner's satisfaction.
- **Competencies Available In-House:** Competencies that can and/or should be performed in-house because the right number, skill level, and mix of resources exist within the owner company.
- **Competencies Unavailable from Contractor(s):** Competencies that cannot be performed by a contractor(s) or to the owner's satisfaction.
- **Competencies Unavailable In-House:** Competencies the should be outsourced to a contractor because the right number, skill level, and/or mix of resources does not exist within the owner company at the present time.

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- **Contractor Shared Competencies:** Responsibility for performing and completing a competency is divided between owner and contractor(s). This division is documented with either an OP/CI, OL/CP, or a CP/OI work relationship.
- **Contractor Information:** Information regarding the ability, skills, and resource availability within the contracting community.
- **Historical Data:** Information pertaining to the characteristics, decisions, and project performance outcomes of previous projects.
- **Organizational Relationship:** Working relationship between owner(s) and contractor(s) to achieve project and business objectives.
 1. **One-Off Relationship:** One-time relationship that ends at project completion or contract fulfillment.
 2. **Repeat Business Relationship:** A more open or integrated team relationship created because of past business dealings but still ends at project completion or contract fulfillment.
 3. **Alliance/Partnering Relationship:** A long-term relationship between organizations used to achieve individual and mutual interests of the organizations.
- **Owner Organization Structure:** Division of primary and support responsibilities for the initiation, development and execution of capital projects between central engineering and business unit/plant within the owner's organization.
- **Project Delivery Approach:** The method by which a project is developed and executed (e.g., design-build, design-bid-build). This also includes the use of single versus multiple contractors.
- **Project Development:** Consists of the business need, concept, and preliminary engineering phases.
- **Project Execution:** Consists of detailed engineering/design, procurement, and construction (EPC) phases.

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- **Potential Project Execution Strategy:** Types of contracts and clauses (lump-sum, cost plus incentive fee), project delivery approaches (design-build, design-bid-build, use of single or multiple contractors), and project organizational relationships that could be used based on the specific project characteristics, project objectives, company policies, and sourcing of key project competencies.
- **Project Management Procedures:** Internal owner policies, usually in written form, that dictate how projects are developed, executed, and managed.
- **Resource Availability:** Availability of personnel within the owner's company to accomplish or leverage the work, whether they are supplied from the business unit/plant or central engineering.
- **Sourcing:** Determining if a competency will be performed using owner resources, contractor resources, or a combination of the two.
- **Staff Supplementation:** The addition of temporary personnel to assist operations. Sources may include consultants, using retirees, temporary services, or contract hire personnel.
- **Start-up:** Transition from mechanical completion to commercial operation.

2.6 Competency List

A list of recommended competencies and their definitions, from an owner's perspective, are used on the different worksheets provided with this handbook. They can be used as a starting point for identifying competencies appropriate to a capital program or specific project. These following competencies are listed alphabetically:

- **Alliance/Partnering:** Utilizing long-term relationships with two or more organizations for the purpose of achieving business objectives.

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- **Benchmarking/Metrics:** Benchmarking — process of assessing and establishing standards to achieve excellence in performance; metrics — process of measuring progress of project performance against established standards.
- **Business Development:** Conversion of owner business needs into project goals.
- **Commissioning/Start-Up/Performance Testing:** Front line development, management, and coordination of operations and/or contractor personnel to proceed toward and prove commercial operation.
- **Conceptual Cost Estimating:** Preparation of estimates at various stages of scope development for purposes of project option selection.
- **Constructability:** Incorporating construction knowledge and experience into project development and execution.
- **Construction:** Installation of permanent facility equipment and materials including all support required to do so.
- **Construction Management:** Management oversight of field construction operations and startup.
- **Convert Research to Project/Scale Up:** Defining project requirements based on new or improved products or processes.
- **Definitive Cost Estimating:** Preparation of estimates for purposes of procurement and project control.
- **Detail Design:** Completion of design drawings and material and equipment specifications.
- **Environmental/Permits:** Ensuring compliance with environmental laws and regulations, filing permit applications, and site assessments.
- **Field Quality Control:** Conducting inspections required to achieve the specified level of quality.

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- **Financial Approval:** Development of appropriation requests, risk analysis for corporate strategy, and project funding approval and decision-making at owner level.
- **Legal/Contract Administration:** Contract negotiation and interpretation to include change order management and dispute resolution.
- **Lessons Learned:** Knowledge gained through the collection and analysis of experiences, successful or otherwise, to be applied to future projects for the purpose of improving performance.
- **Maintenance & Operability:** Incorporating input from maintenance and operations personnel during project development and detail design phases.
- **Preliminary Design/Scope Development:** Conceptual preparation of overall project design and scope.
- **Process/Conceptual Design:** Process definition and feasibility analysis congruent with overall project objectives, including owner proprietary process know-how.
- **Procurement:** Corporate procurement buying strategy, contractual arrangements, and vendor inspections.
- **Project Controls:** Identification and reporting of actual and potential cost and schedule deviations.
- **Project Management:** Management and coordination of project development and execution.
- **Project Management Oversight:** Leadership of owner effort of project development and execution, including decision-making authority.
- **Project Planning/Scheduling:** Determination of project development and execution strategies such as contracting plan and materials management plan.

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- **Risk Management:** Assessment, analysis, planning, and control of risks on a project.
- **Safety:** Ensuring or supporting compliance with operating facility and OSHA regulations and requirements, including construction safety.
- **Setting Project Goals, Objectives, & Priorities:** Establishing key project requirements and prioritizing these requirements to meet business development needs for the project.
- **Team Building:** A project-focused process that builds and develops shared goals, interdependence, trust, commitment, and accountability among project team members.
- **Technical Expertise:** Specific equipment, systems, or technological specialization.
- **Total Quality Management:** Provide continuous work process improvement methodology during project development and execution.

Some additional competencies that may be important for given situations are listed and defined below. They are not included on the worksheets used in the guidelines by may be added if required or deemed appropriate to a capital program or project.

- **Labor/Craft Training:** A specific competency within construction where effort is spent training labor/craft so as to increase productivity or ensure compliance with a standard, government regulation, or public policy.
- **Labor Relations:** Negotiating with labor to reach a work agreement and management involved to comply with the agreement and maintain good relations.
- **Local Codes/Standards:** Knowledge or understanding of local design, construction, quality, safety, and/or environmental codes or standards as well as an understanding of conducting business in a specific locality, especially on international projects.

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- **Process/Conceptual Design**
 - **Crude Oil Refining**
 - **Coal Fire Cogeneration**
- **Technical Expertise**
 - **Metallurgy:** Setting standards, specifications, and performance requirements for metallic materials and performing inspections/analysis to ensure compliance for particular process needs.
 - **Rotating Equipment:** Specifying, designing, and providing technical expertise for rotating equipment to meet scope or process performance requirements.

All terms presented in this chapter are used extensively in the next two chapters. Understanding these terms is essential for successfully applying each work process.

Chapter 3: Owner Work Structure Process: Corporate Approach

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A hierarchical framework that depicts functions of the *corporate work structure process* is shown in Figure 5. At the first level of decomposition, the corporate work structure process is comprised of two functional areas: **Determine Key Capital Program Competencies (A1)** and **Evaluate Sourcing of Competencies (A2)**. Each area includes a series of more specific sub-functions (A11, A12, etc. in Figure 5) whose performance is facilitated by a pre-designed worksheet. Information required to perform this work process has a corporate-level focus (see Figure 3). Corporate decision-makers responsible for this process may include vice presidents, general managers, and department managers responsible for capital programs and the resources that support capital programs.

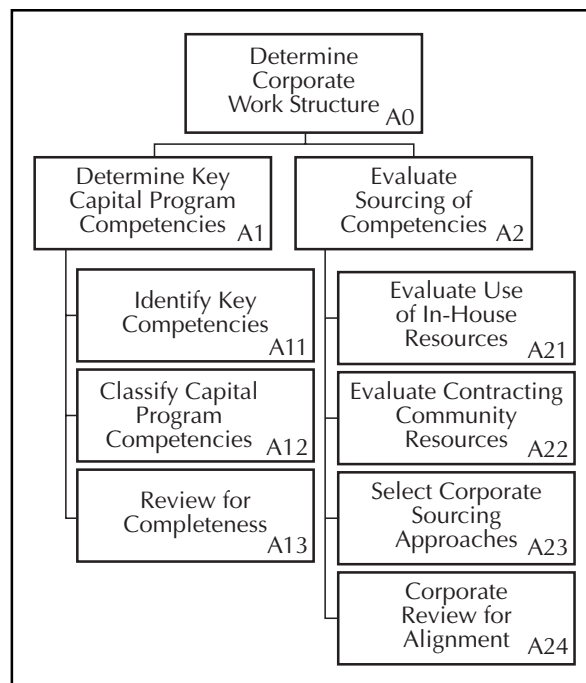


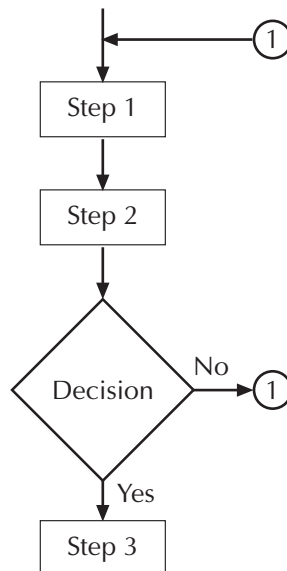
Figure 5. Corporate Work Structure Hierarchical Framework

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In the sections to follow, each process function shown in the framework (Axx) has a decision flow chart that describes it. These decision flow charts present a number of steps, decisions, and general information that must be considered when performing a process function. This information is represented by a different symbol. The meaning of each symbol is explained as follows:

-  Step that must be executed
-  Elements or key issues that must be considered
-  Decision points or questions raised
-  General information provided

These symbols are used consistently throughout to convey similar information.



A circled number on a figure refers to a corresponding section on the large, folded flow charts (housed in the inside pocket of the binder).

3.1 Determine Key Capital Program Competencies - A1

A1 is the first major functional area for determining an appropriate corporate work structure.

3.1.1 Identify Key Competencies - A11

The decision flow chart for process function A1 is shown in Figure 6. This function identifies and describes key competencies based on a capital project program including product mix, typical project characteristics, a strategic plan, and company policies and procedures.

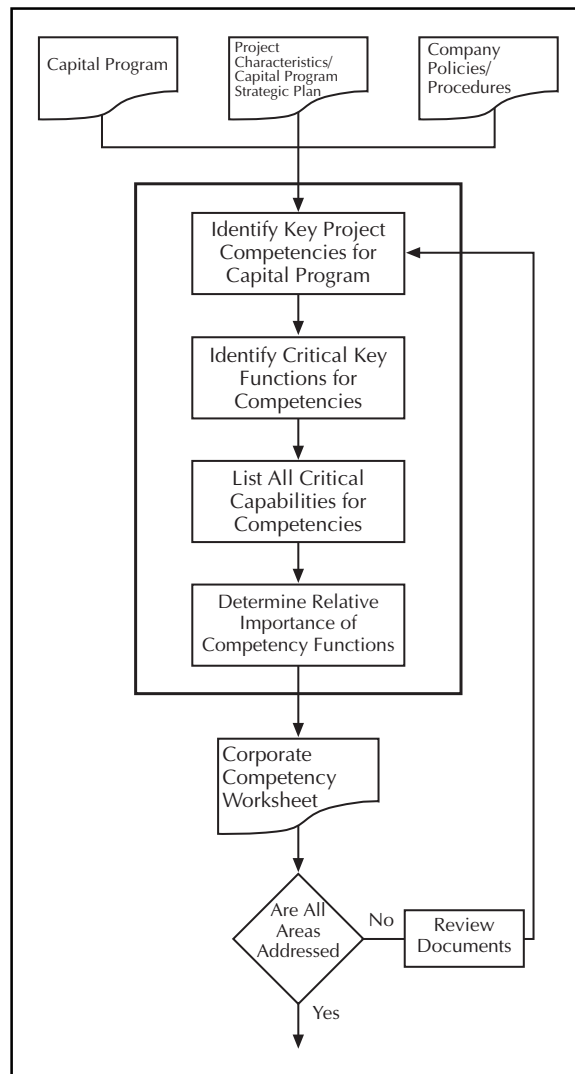


Figure 6. Identify Key Competencies

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The capital program strategic plan is perhaps most important. The plan prioritizes objectives and critical success factors for projects based on product-to-market factors. The capital program strategic plan influences the identification of competencies for the entire capital program.

Each competency that is identified should be well-defined. Each competency should also be defined in terms of its functions and critical capabilities. This step creates a common language within an organization.

Defining competencies in terms of functions and critical capabilities provides greater detail. This should assist in classifying competencies either as core or as non-core and also in the sourcing of them for a capital program.

A detailed description of sections of this process function decision flow chart follows.

Prior to the commencing the Corporate Work Structure process, certain key information must be available as depicted in Figure 6a. This information includes:



Capital Program Requirements:

- Total budget for capital project expenditures per year
- Capital budget for each type of project developed for each business unit
- Capital program planning horizon
- Excludes maintenance expenditures



Project Characteristics

- Types of projects associated with business units
- Location of projects (regional in U.S. and/or international regions)

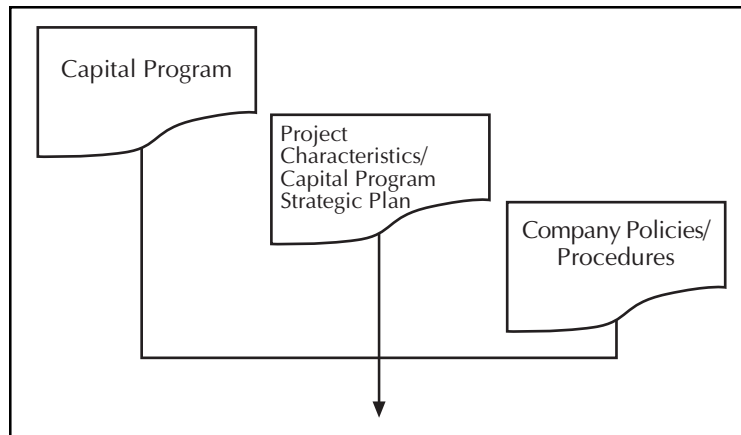


Figure 6a. Identify Key Competencies-A11

- General classification of projects by complexity and dollar size
- Technologies involved and their proprietary nature
- New facilities, expansion of existing facilities, or modernization of existing facilities



Capital Program Strategic Plan:

- Policy Guidelines:
 - Reduce fixed cost
 - Increase market share
 - Reduce product unit cost
- Strategic Objectives:
 - Maximize internal rate of return
 - Reduce capital cost of projects by 15 percent
 - Improve schedule performance by 10 percent
- Critical Success Factors:
 - Internal rate of return of at least 20 percent
 - Low life cycle cost
 - Shortest time-to-market

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- Key Action Areas:

- Use standard process design
- Use accelerated scheduling techniques
- Minimize process steps
- Eliminate errors and rework
- Improve labor productivity
- Implement constructability



- Company Policy/Procedures:

- Use project management procedures
- Apply total quality management to improve project processes
- Target resource levels for capital program organization (number of people)



Corporate decision-makers must understand their capital program requirements, capital program strategic plan including priorities, and company policy/procedures before starting the process.



The first step is to identify key capital program competencies. Key competencies for a capital program are identified based on the requirements of the capital program, capital program strategic plan, company policies/procedures, and typical project characteristics.



Historical data can guide the identification of capital program competencies.



This step can be performed for the corporation as a whole, by business unit, or by location (U.S. vs. International), or by any other perspective corporate decision-makers deem appropriate.



The next step is to determine critical key functions for each capital program competency. This step is performed to help clarify the role that the owner will assume for a specific key competency.

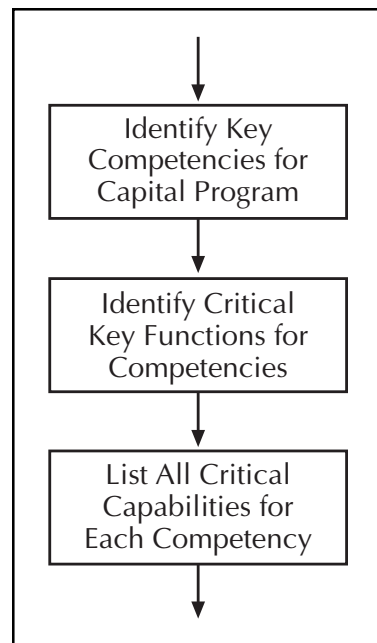


Figure 6b. Identify Key Competencies-A11

- ✓ Functions include steps, activities, or tasks that convert input to output for a project competency.
- ✓ Clearly defining key functions of a competency is extremely important. Sufficient time should be allowed to complete this step.
- ☞ After all functions for each competency are determined, a list including critical capabilities required to perform competency functions must be prepared.
- ✓ Critical Capabilities define specific skills, experience, and knowledge needed to perform competency functions.
- ✓ A company may already have a list of potential functions and associated critical capabilities by project type that reflects the requirements for that project type.

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- ✓ Corporate decision-makers have to clearly define critical capabilities for specific functions for each competency performed by the owner.

 An example of a competency with its key functions and associated critical capabilities is shown below:

Conceptual Cost Estimating

Definition	• Preparation of estimates at various stages of scope development for purposes of project option selection.
Functions	• Determine estimate basis (scope) for facility components. • Determine historical cost basis for facility components. • Convert estimate basis to costs. • Compare with previous facility costs. • Check key cost relationships/ratios. • Review cost estimates with project team. • Approve cost estimates by corporate management including acceptable ranges.
Critical Capabilities	• Ability to visualize entire project. • Understand technology involved. • Construction knowledge and experience. • Understand how major facility components fit together. • Understand estimating process - Conceptual estimating techniques and methods. - Data sources. - Cost elements: ratios and relationships. • Ability to review and understand estimates. • Project controls background with design/construction experience.

 Four additional competency examples are provided in Appendix D.

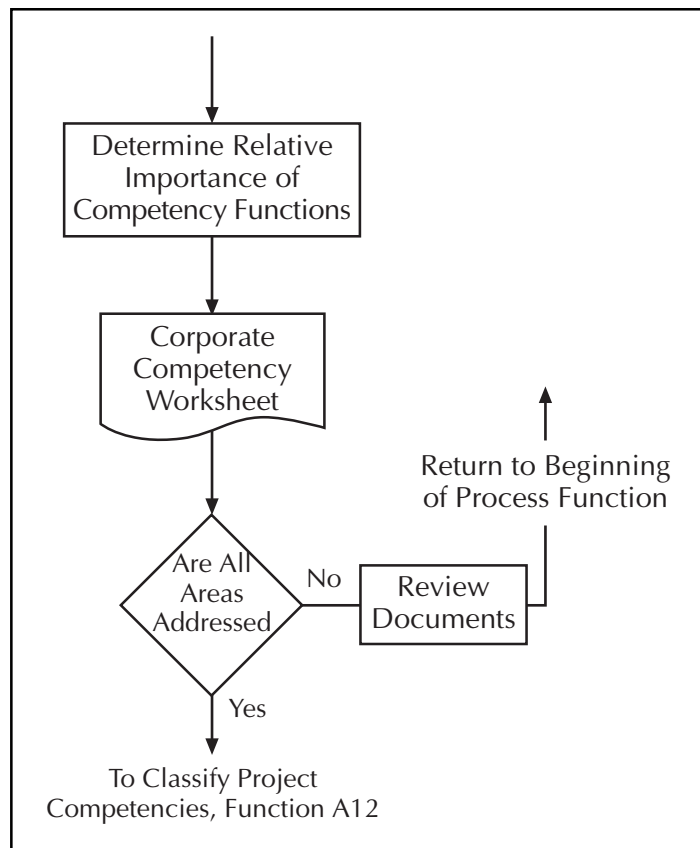


Figure 6c. Identify Key Competencies-A11

☞ Once each capital program competency is defined, the relative importance of performing competency functions with owner resources is determined.

✓ Corporate decision-makers must determine which competency functions are most influential in achieving capital program success. Performing these functions must support the capital program strategic plan and company policies and procedures. This ensures that the owner focuses on those competencies that are most critical to project success.

☞ At the end of the process a comprehensive list of capital program competencies is developed and documented onto the Corporate Competency Worksheet.

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A partial Corporate Competency Worksheet is shown below.

CORPORATE COMPETENCY WORKSHEET
Competency
Alliances-Partnering: Utilizing long-term relationships with two or more organizations for the purpose of achieving business objectives.
Benchmarking-Metrics: Benchmarking is the process of assessing and establishing standards to achieve excellence in performance; Metrics is the process of measuring progress of project performance against established standards.
Business Development: Conversion of Owner business needs into project goals.

✓ At this point in the process, only capital program competencies have been identified and documented on the first half of the worksheet.

✓ A complete set of Corporate Competency Worksheets is provided in Appendix B

◇ After developing a Corporate Competency Worksheet, corporate decision-makers review the selected competencies, check if all capital program competencies have been addressed, and ensure that determination of competencies is congruent with the capital program, its strategic plan, project characteristics, and company policies and procedures.

☞ Corporate decision-makers should review all documents, information, and selected competencies to ensure the list of capital program competencies is complete.

✓ Any adjustments to the Corporate Competency Worksheet should be made as necessary.

3.1.2 Classify Capital Program Competencies - A12

The next process function, as delineated in Figure 7, is to **Classify Capital Program Competencies (A12)**. At this stage of the process decisions are made as to whether a competency is core or non-core. A core competency is one that is *critical to project success* and *must reside* with the owner.

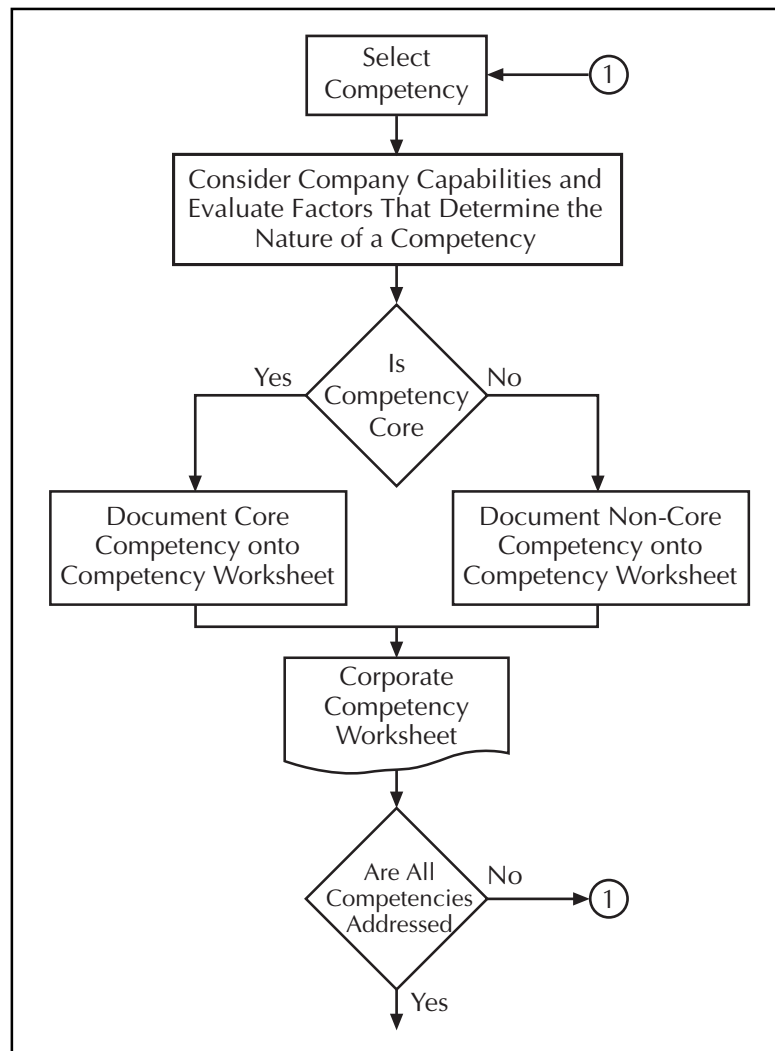


Figure 7. Classify Capital Program Competencies

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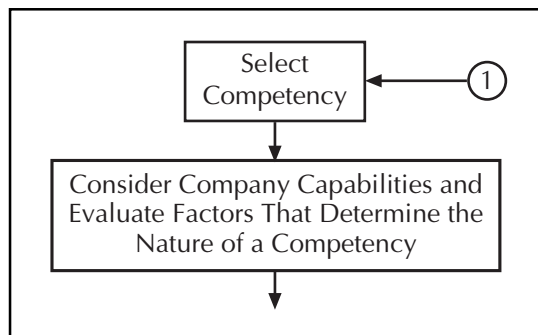


Figure 7a. Classify Capital Program Competencies-A12

These competencies are considered core because they support the owner’s corporate business strategy and plan. Core competencies also have potential financial and legal implications.

The decision of core versus non-core is highly influenced by the capital program strategic plan, company capabilities, project characteristics, and company policies. The capital program strategic plan can dictate the direction that the owner capital projects’ organization takes and, therefore, influence which competencies are core for the capital projects’ organization.

A detailed description of sections of this process function decision flow chart follows.

☞ **Once a project competency list is generated and documented onto the Corporate Competency Worksheet, corporate decision-makers determine whether or not a competency is core or non-core for the company. Two steps are performed. These steps are performed for each competency, one at a time. First, company capabilities are considered.**

- ✓ Company capabilities are major areas within the capital projects’ organization that the owner has retained the necessary resources to perform certain competencies. Company capabilities not retained by the owner are most likely outsourced.

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✓ Corporate policy directives, business strategies, and capital program strategies determine company capabilities. For example, if a company has decided not to perform detailed design, the owner organization would consider this competency non-core because it is not considered a company capability.

✓ At this point in the process the issue of resources (personnel) is not considered when making these types of decisions, only the general capability of an owner to perform specific competencies.

☞ **The second step is to evaluate other factors that might determine whether or not a competency is core or non-core for the capital program.**

📄 Factors that might be considered when deciding the nature of a competency are:

- | | |
|-----------------------------------|---|
| • Front end related competencies | • Related to core business |
| • Process proprietary technology | • Critical to long-term maintenance and operation of facilities |
| • Cost efficiency | • Corporate/business/engineering strategy |
| • Leadership related competencies | • Financially driven |
| • Competitiveness | • Directly aligned with corporate/business goals |
| • Safety | • Interface points during project development and execution |
| • Liability and Risk | |
| • Financial state of company | |

✓ For example, if the type of technology involved in certain capital projects is proprietary, competencies related to this technology are selected as core and have to reside in-house. Proprietary technologies are critical to the success of the capital program and, ultimately, the business unit.

- ✓ Key factors should be identified and their impact on the capital program determined in the context of the capital program strategic plan, typical project characteristics, and mode of operation and environment in which the company performs its business.

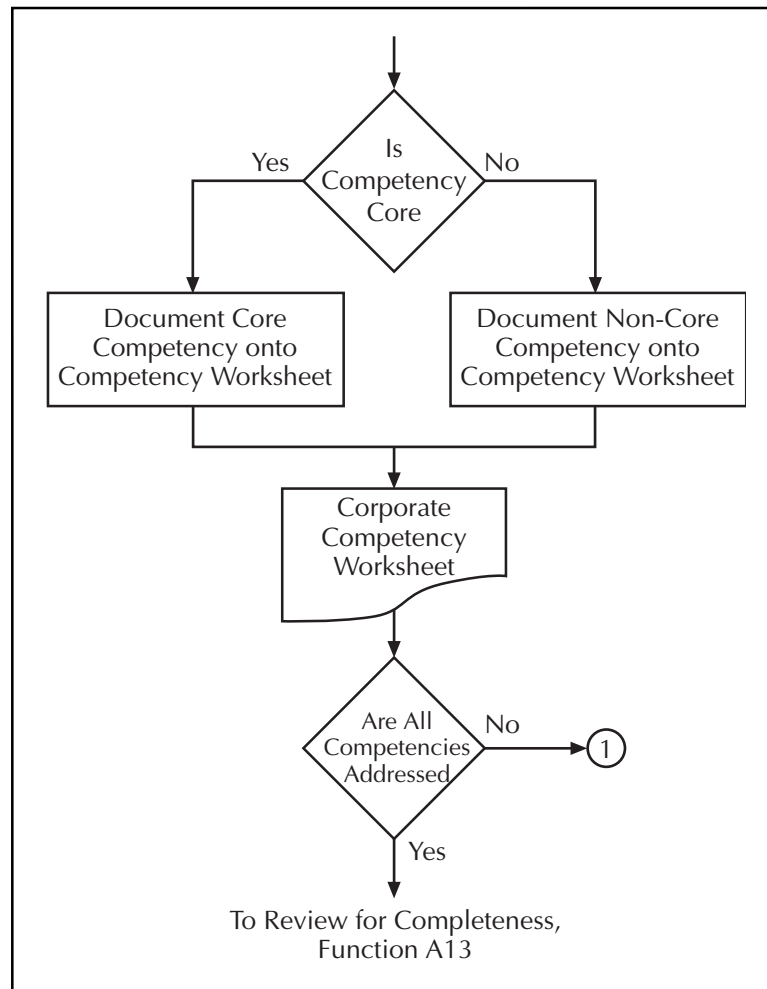


Figure 7b. Classify Capital Program Competencies

- ✓ These factors can be evaluated at a function level. If a function or a set of functions for a specific competency is determined core for the owner, then this part of the competency is determined core and must be maintain in-house.

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❖ After company capabilities and other key factors are evaluated, corporate decision-makers decide if a competency or part of a competency (i.e., one or more functions) will reside in-house as a core competency.

☞ The selection of a competency as core or non-core is documented on the Corporate Competency Worksheet in one of the last two columns of the worksheet.

📄 A partial Corporate Competency Worksheet is shown below.

CORPORATE COMPETENCY WORKSHEET		
Competency	Core Competency	Non-Core Competency
Alliances-Partnering: Utilizing long-term relationships with two or more organizations for the purpose of achieving business objectives.		
Benchmarking-Metrics: Benchmarking is the process of assessing and establishing standards to achieve excellence in performance; Metrics is the process of measuring progress of project performance against established standards.		
Business Development: Conversion of Owner business needs into project goals.		

❖ The next decision point queries whether or not each competency on the worksheet is identified as either core or non-core to the capital program.

✓ Once all competencies are addressed, then the process proceeds to Review for Completeness (A13).

✓ If not all competencies have been addressed, then the next competency on the Corporate Competency Worksheet is addressed.

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3.1.3 Review for Completeness - A13

As shown in Figure 8, when **Reviewing for Completeness (A13)**, corporate decision-makers scrutinize process outputs to determine if all key competencies have been identified and defined, including their functions and critical capabilities.

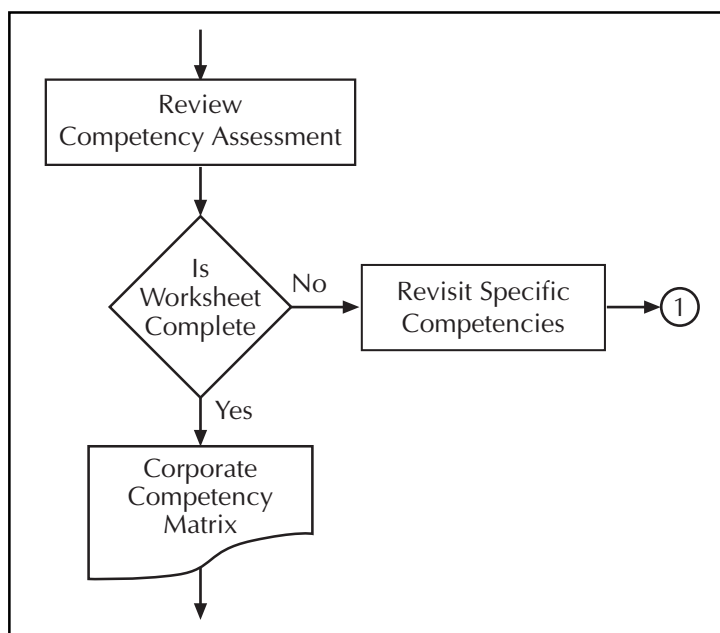


Figure 8. Review for Completeness

Corporate decision-makers check if competencies have been appropriately classified. Part of the review may include seeking input and/or approval from top corporate decision-makers and other stakeholders.

Executive management within the company that have knowledge of corporate and business strategies should be consulted. This review should also insure that the Corporate Competency Worksheet is congruent with company policies and procedures.

If other potential competencies are identified as a result of the review, they should be defined and classified before continuing. Moreover, this review could affect the classification of some competencies. For example, a

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core competency could be changed to a non-core competency and vice versa. An objective of this function is to ensure the thoroughness of the two previous functions. The product or outcome of this function is a Corporate Competency Matrix, that is, an approved Corporate Competency Worksheet. This product is an input for the next functional area, **Evaluate Sourcing of Competencies (A2)**.

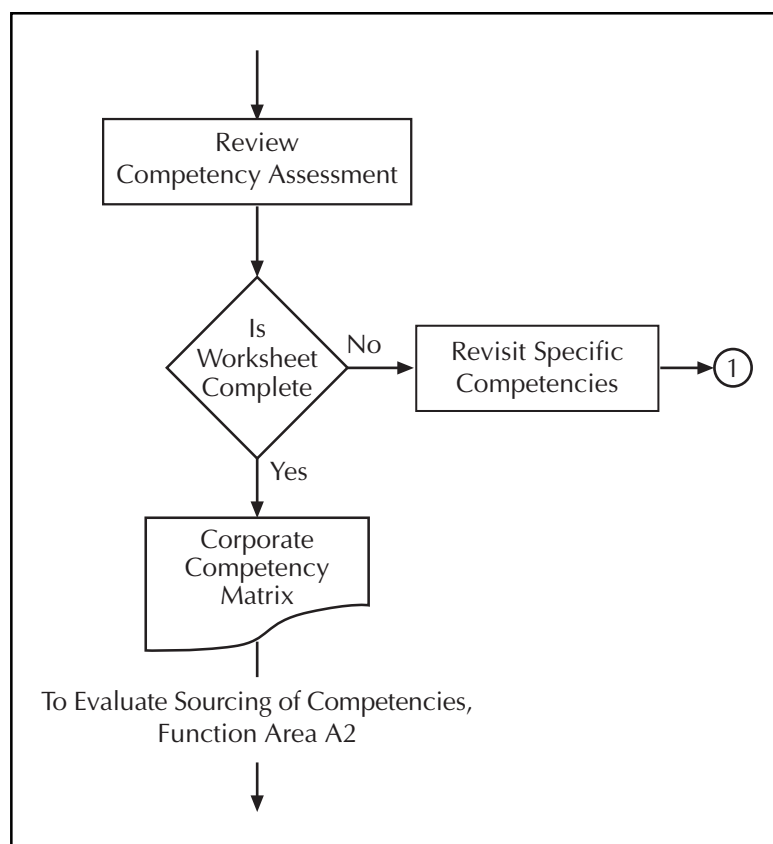


Figure 8a. Review for Completeness-A13

👉 Corporate decision-makers perform an assessment of the Corporate Competency Worksheet for completeness. This assessment ensures that each competency is properly defined and categorized as to either core or non-core.