

the art of engineering



ENGINEERING PROJECT EXECUTION

- "A BAD BEGINNING MAKES A BAD ENDING." -
(A white paper)

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Executive Summary

Applying the lessons learned through the ages when carrying out an engineering project results in cost savings. Engineering is the practical application of scientific knowledge, in a tradition of excellence. It is an art form of creativity employed in the design and implementation of projects. Successful projects are fundamentally dependent upon the degree and quality of work performed in planning.

Pfeiffer Engineering has identified and confirmed that the following elements are critical when engineering a project:

- Formalizing the project definition
- Developing a detailed project scope and functional specification
- Carefully monitoring and controlling project implementation
- Providing ongoing support after commissioning and startup

Expected benefits of this project management methodology include:

- Accomplishment of the task with minimal disruption and downtime for the client
- Completion on schedule
- Completion within budget
- Minimized ongoing maintenance costs (Total Cost of Ownership)
- Reaching design operating efficiencies
- System performance meeting or exceeding expectations of all parties

In short, this professional leadership, as demonstrated by Pfeiffer Engineering, promises that the project's expectations are met, enabling the project to achieve its purpose of reducing cost or adding value to the business.

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Context

Over two thousand years ago, Euripides (480 or 485–406 B.C.) coined the phrase:

"A bad beginning makes a bad ending."

Experience teaches us to pay attention to history and implement the lessons we learn from it. In James Ford Rhodes' book History of the Civil War, 1861-1865 he wrote:

"Anyone used to affairs knows that there are times when, after a bad beginning everything seems to go awry, perplexity reigns and no remedy appears; when ordinary men are bewildered and know not what to do."

When will we ever learn? Shouldn't we apply the lessons learned through the ages to carrying out an engineering project? Engineers must never lose sight of the fact that engineering is more than a profession. It is the practical application of scientific knowledge. The practice of engineering is rooted in a tradition of excellence. It is also an art form. The "art" is in the creativity employed in our designs and in implementing those designs. Successful projects are fundamentally dependent upon the degree and quality of work performed in the planning phase(s).

Engineers must constantly think of themselves as being in the "Risk Minimization Business". It is incumbent upon the engineer to make certain that there is only nominal risk, not only for the client and the firm, but also for all concerned in the project. Potential risks include, but are certainly not limited to, cost overruns, delays, lost production time, sub-standard performance or even abandonment of newly installed systems because they just don't work as expected. The risks increase as project complexity increases. This is particularly true when software is involved.

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A Four-Step Approach

At Pfeiffer Engineering, we have a proven project methodology. We have identified and confirmed that the following four steps are critical to the successful completion of a project:

1. Formalizing the project definition
2. Developing a detailed project scope and functional specification
3. Carefully monitoring and controlling project implementation
4. Providing ongoing support after commissioning and startup

No matter the degree of complexity in a project there are a few goals that are constants. The only valid reasons for undertaking a project are to reduce the cost of or add value to the client's business. The client needs the project to "work". Defining what that term means can be very difficult. This is particularly true in the world of software development. Among the criteria that define the meaning of the term "working" are:

- Accomplishment of the task with minimal disruption and downtime for the client
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Formalizing the Project Definition

To paraphrase Lewis Carroll's Alice's Adventures in Wonderland, "without a plan, all roads will get you there". What remains unsaid is the amount of risk incurred and the cost of getting there without a plan. Project planning starts with the process of formally defining the job to be accomplished. Unambiguous communication among all parties involved is vital to the success of any venture and is paramount in the Project Definition step. This is the most critical period of the project. It is here that the objectives of the project are validated and confirmed.

There must be mutual agreement at all levels to provide a quality scope, functional specification, and detailed list of deliverables that meet the client's needs and expectations. These documents must be in writing and presented in a highly organized manner to guarantee complete understanding. The interests of all parties impacted by the project must be represented. Each must accept ownership and accountability and each must demonstrate "buy in". If this is not the case, then serious questions about the internal political situation must be answered. These questions may include: Why are the operators not involved? Why isn't Maintenance involved? Why is this a secret project? There may be valid reasons for exclusion of specific individuals or groups but the engineer must be a party to those reasons and take them into consideration for the later phases of the project.

The team will formally state the purpose of the project within the context of existing problems and/or shortcomings. Explicit benefits of the project will be identified. Specific and measurable goals are also identified and validated. The validation process assesses the cost savings and/or added value resulting from implementing the project.

The project owners will be identified. This role may shift during the project from those who are responsible for approving the project to those who will take ownership when it is complete. The owner's focus will be on what the project is about and the benefits to be derived. They must be comfortable in the knowledge that a well-defined project will meet both their needs and expectations. They must clearly understand the impact of the project on people, systems, and processes.

A formal Project Definition assures the owners that their risk is minimized. It prevents unnecessary changes during implementation; those changes will cost money. The owner must authenticate the need for the project. The formal process of preparing a detailed project definition may reveal that the project should not go forward. In addition to the money saved, avoiding the pain and professional embarrassment associated with a failed project is worth the time and nominal cost of this vital step.

The project's customers are identified and documented during this phase. The customers' focus is on how the end product of the project will work. The project team must be sure that the end-users concerns are represented. Likewise, the end-user must be made aware of the role(s) they will play throughout all phases of the project.

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Employing the services of a professional engineering firm to develop a project definition is very advantageous to the client. In today's world, the client's engineering staff is already fully occupied in dealing with day-to-day operation and maintenance issues. They are continually challenged to do more with fewer resources and do not realistically have the time to do a thorough job in preparing a new project definition. It is almost impossible for them to stay current with the latest equipment, technology and application techniques. Have you ever been a part of an effort that failed because it was rushed to completion with insufficient attention to detail?

A professional engineering firm brings expertise gained from experience with a broad range of equipment and leading edge technologies. The firm's staff offers extensive skill sets gained through working in different industries and with numerous companies. This expertise produces efficiencies gained through experience in writing complete and appropriate functional specifications. This is an enormous value preventing expense and delays associated with the dreaded "scope creep" and "change orders" common to poorly defined projects.

Expectations from employing such a firm include a site-based evaluation complete with budgetary implementation costs and a formal Project Definition Report. Elements of the report include as a minimum:

- Statement of project objective
- Benefit analysis
- Description of current process
- Description of proposed process
- Basic technical specifications
- List of functional requirements
- Process flow diagrams
- Implementation schedule
- Detailed listing of participants, their responsibilities and interface points
- Definition of project boundaries
- Staffing requirements

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The Need for a Detailed Project Scope

The Project Scope refines the Project Definition by clearly documenting the project goals and clearly quantifying and qualifying the criteria to be used in measuring the success of the project. It includes a Functional Specification that provides the basis for competitive bidding. It further reduces the risk of having to make costly changes during implementation.

Sadly, it is quite common for a company with a perceived project need to task an employee to get some pricing for having a project done. Most often, the party tasked doesn't fully understand the manager's idea but sees this request as an order that must be completed without question. He or she calls in one or more companies believed to be capable of carrying out the work, hurriedly walks them through the plant talking and waving in the general direction of the work they think should be done.

It is more common than not that these "walk-throughs" are conducted individually and each prospective bidder goes away with a unique perspective of what was said about the project. What the potential supplier heard may not even remotely resemble the intent of the originator. This scenario is played out daily. It completely undermines the actual intent of management because it prohibits rather than promotes receipt of truly comparable competitive bids.

What is the value of proposals made to an unknown or misunderstood scope? Do you really want a "low ball" bid with change orders and unacceptable deliveries for a project that likely will not provide what you are looking for? How can you hold the contractor accountable for what you said if it wasn't in writing? Wouldn't you really rather get an accurate and fair price for a project that meets your needs?

Getting the details right saves money. A well-written Project Scope document reduces risk for the contractor because they know exactly what will be required of them. It saves the client money because contractors don't have to include pricing contingencies to cover the unknown issues that always come up in poorly defined projects.

It is therefore, economically advantageous to use the services of a professional engineering firm to assist in the preparation of the Project Scope documents. This is true for many of the same reasons addressed earlier and, possibly more importantly, the work gets done in timely fashion. Professional engineering firms work with the client to develop the package. The client's continued involvement insures that projects will not be "gold plated".

The professional engineer provides the Project Scope report for the client's internal use. It is aimed at senior management, it documents the project, and it provides the basis for funding. It also includes reliable costs for the detailed engineering required for implementation.

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The Functional Specification, included in the Project Scope, explicitly defines the project and reduces project cost by minimizing risk to all parties. This document is designed and formatted to be useable as part of a request for quotation and/or an attachment to a contract.

Monitoring and Controlling Project Implementation

With all of the above said and done, analysis of successful project implementations has shown that a synergy develops among the project team members. This synergy only occurs when the team members achieve a common vision. That vision is a deep-seated understanding of the project's objectives, critical path schedule, and an appreciation for each team member's contribution. It is born and nurtured by the Project Definition and Project Scope phases.

During implementation the project schedule is formalized and the system is developed according to the Functional Specification. Phased, fully validated deliveries, installation and commissioning of equipment and operating systems occur. Operator training is conducted. Startup, demonstration of performance, and formal turnover of the system to the owners takes place.

The implementation phase should be the fun part where the dream becomes reality. It takes less time overall and costs less when properly planned and all the steps are performed in an orderly, professional manner.

Ongoing Support After Commissioning And Startup

System owners are well advised to make sure they have identified resources for ongoing support. Those resources must be available with appropriate leadership that has demonstrated capability through a history of successful projects. The firm must have qualified staff that can support future needs for upgrades or enhancements to the installed project. This is a crucial consideration in light of total cost of operation.

Conclusion

The most successfully implemented projects have been well defined and have utilized detailed project scope documents resulting in lower implementation costs, minimized risks and truly effective solutions. Pfeiffer Engineering's Four-Step approach provides the structured methodologies that guarantee success.