

Proceedings of Government/Industry Forum: The Owner's Role in Project Management and Preproject Planning

Committee for Oversight and Assessment of U.S. Department of Energy Project Management, National Research Council

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PROCEEDINGS OF GOVERNMENT/INDUSTRY FORUM
The Owner's Role in
Project Management and
Preproject Planning

Committee for Oversight and Assessment of U.S. Department of Energy
Project Management

Board on Infrastructure and the Constructed Environment

Division on Engineering and Physical Sciences

National Research Council

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Preface

Recurrent problems with project performance in the U.S. Department of Energy (DOE) in the 1990s raised questions in Congress about the practices and processes used by the department to manage projects. The 105th Committee of Conference on Energy and Water Resources directed DOE to investigate establishing a project review process. DOE requested the assistance of the National Research Council (NRC), which resulted in the publication of the report *Assessing the Need for Independent Project Reviews in the Department of Energy*.¹ Congress subsequently directed DOE to undertake a review and assessment of its overall management structure and process for identifying, managing, designing, and constructing facilities, and the DOE asked the NRC to conduct an independent review and to develop recommendations to improve DOE's management of projects. The NRC published the report *Improving Project Management in the Department of Energy*,² which provided a set of findings and recommendations for improving project management and noted that improvement would require a program of reform for the entire project management process. These issues were followed up and expanded in the subsequent reports, *Characteristics of Successful Megaprojects*,³ *Improving Project Management in the Department of*

¹NRC (National Research Council), 1998, *Assessing the Need for Independent Project Reviews in the Department of Energy*, Washington, D.C.: National Academy Press.

²NRC, 1999, *Improving Project Management in the Department of Energy*, Washington, D.C.: National Academy Press.

³NRC, 2000, *Characteristics of Successful Megaprojects*, Washington, D.C.: National Academy Press.

Energy,⁴ and *Progress in Improving Project Management at the Department of Energy: 2001 Assessment*.⁵

Many of the findings and recommendations in this series of reports identified the need for improved planning in the early project stages (front-end planning) to get the project off to the right start, and the continuous monitoring of projects by senior management to make sure the project stays on course. These reports also stressed the need for DOE to act as an owner, not a contractor, and to train its personnel to function not as traditional project managers but as knowledgeable owner's representatives in dealing with projects and contractors.

The NRC Committee for Oversight and Assessment of Department of Energy Project Management determined that it would be helpful for DOE to sponsor a forum in which representatives from DOE and from leading corporations with large, successful construction programs would discuss how the owner's role is conducted in government and in industry. In so doing, the committee does not claim that all industrial firms are better at project management than the DOE. Far from it—the case studies represented at this forum were selected specifically because these firms were perceived by the committee to be exemplars of the very best practices in project management. Nor is it implied that reaching this level is easy; the industry speakers themselves show that excellence in project management is difficult to achieve and perhaps even more difficult to maintain. Nevertheless, they have been successful in doing so, through constant attention by senior management.

Through this forum, the committee hoped to reinforce some of the other general points made in the above-cited earlier reports. The points include the following:

- Successful project management requires the institution of a project management discipline that encompasses all projects. It is not sufficient to do some projects well; what is needed is consistency. All the firms represented in the forum have well-defined, disciplined project processes, with buy-in and active participation by senior management.
- There is an absolute requirement for emphasis on project justification and identification of business or (in the case of DOE) mission need early in every project, even before a project is formalized. Senior corporate (agency) management must be closely involved in this process, as it is their responsibility to identify and interpret business or mission needs.

⁴NRC, 2001, *Improved Project Management in the Department of Energy*, Letter report, Washington, D.C.: National Academy Press.

⁵NRC, 2001, *Progress in Improving Project Management at the Department of Energy: 2001 Assessment*, Washington, D.C.: National Academy Press.

- Decision points with options for project approval, go-ahead, change, re-work, or termination must be clearly identified. These decisions must be made by appropriate senior managers. The view that the need for senior management decisions slows down good projects is explicitly rejected. A good decision process actually expedites projects, in that it assures that they have the necessary resources, support, and direction to go to successful completion and operation—not merely to the next phase.
- Accountability and responsibility for project performance must be made clear and well defined across the enterprise. For the enterprise to succeed, all elements must succeed.
- A corporate organizational structure for project management must be established and maintained.
- There must be continual, formal project reviews by responsible management.
- Expectations, products, and metrics must be clearly defined for the entire process.
- There is no substitute for thorough front-end planning. This is true even (better, especially) for first-of-a-kind and one-of-a-kind projects.
- A successful project-management improvement process requires a cultural change, and cultural change is driven from the top.

The speakers covered all these points, and more.

The committee expresses its great appreciation to all the speakers at the forum who generously provided their time and candidly shared their experience and hard-won knowledge about project management:

- Robert G. Card, Undersecretary, DOE,
- Bruce Carnes, Chief Financial Officer, DOE,
- Joseph Gregory, Projects Coordinator, ChevronTexaco Project Resources Company.
- Steven Harker, Project Benchmarking Manager, Weyerhaeuser Corporation,
- Edward Merrow, President, Independent Project Analysis, Inc., and
- James B. Porter, Jr., Vice President, Engineering and Operations, E.I. du Pont de Nemours and Company,

Special recognition is also due to Theodore Kennedy, Chairman, BE&K, Inc., who initiated, organized, and conducted the forum, and to the NRC Board on Infrastructure and the Constructed Environment, which supported it.

The Government/Industry Forum on the Owner's Role in Project Management and Preproject Planning, held on November 13, 2001, served as a venue for

exchanging lessons learned in successful project management between major industrial corporations and the DOE. The committee offers this publication in the hope that these lessons learned may be useful to a wider audience.

Kenneth F. Reinschmidt, *Chair*
Committee for Oversight and Assessment of U.S.
Department of Energy Project Management

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1

Introduction to the Government/Industry Forum

*Kenneth F. Reinschmidt, Chairman
Committee for Oversight and Assessment of
U.S. Department of Energy Project Management*

The work of the National Research Council's Committee on Oversight and Assessment of U.S. Department of Energy Project Management can be traced back to 1998, when there was a one-person report by Lloyd Duscha, *Assessing the Need for Independent Project Reviews in the Department of Energy*. His report led to expansion of the agency's external review process and changes to it.

In the wake of the report, an NRC committee was formed that had one objective—to write a report on assessing project management in the DOE. That committee finished its work in December of 1998 and produced the 1999 report *Improving Project Management in the Department of Energy*.

The present committee, often called the Phase III committee, was appointed to continue the work identified by the original committee. It has a determinate life of 3 years. On January 17, 2000, it issued a letter report, *Improved Project Management in the Department of Energy*, to the Secretary of Energy. In November 2001, it issued its latest report, *Progress in Improving Project Management at the Department of Energy: 2001 Assessment*.

In addition to the written reports, the committee has been looking for other ways of promoting two-way communications with DOE about a number of specific issues that had engaged its attention. This forum was organized to exchange information in two areas:

1. DOE's role as a project owner but not necessarily a direct manager of projects.

2. Preproject planning, also known as preconstruction planning or front-end planning. The committee strongly feels the quality of DOE's front-end planning is a key factor in determining the outcome of DOE projects.

Today's program consists of three parts: First, we will hear from Undersecretary Card and Chief Financial Officer Carnes, both from DOE. Second, we will hear presentations by industrial corporations that act as owners and clients for projects. Committee member Ted Kennedy organized the industrial session. The presenters here today represent the companies who in the opinion of the committee are exemplars of the best in project planning. Finally, there will be a question-and-answer session, with questions from the floor directed to the presenters who served as panelists.

2

DOE's Role as Project Owner

*Robert G. Card, Undersecretary
U.S. Department of Energy*

DOE's core competency is big projects. When we have a problem with them, the very essence of our niche in the government is undercut.

But I would also point out that the department has had 40 plus years to get where it is. It is a very mature and resilient system. It will not be changed with anything less than a 6 × 6. A 2 × 4 or a splinter of regulation will not do the job.

One thing that is problematic for DOE is deciding what is a project and what is not. Clearly, if we build something, we call that a project. But DOE's largest program is in tearing things down, not building things. I would submit that DOE has a lot of projects going on that people don't treat as projects. And they are being delivered in a less desirable way because of that. So one of the first orders of business is scoping out and mapping what the business is about and what is a project and what is not. Where should project management tools be applied and where should they not?

I am looking at an array of management initiatives at DOE, starting with safety, that mostly hinge on one thing: What is the role of DOE in its interface with the contractor? I think one of the areas where DOE has given mixed signals, both internally and with the contractors, is in its interface with the contractor. In my view, DOE should think of itself more as a developer and an investor, not as a project manager. When it thinks of itself as a project manager, it wants to go in and control the project. When I did work for the three companies presenting today, I never had a member of one of those companies involved in the level of detail about how I was going to get the work done that I do with DOE.

When I worked for these companies, they spent a lot of time deciding what they were going to buy and in establishing the requirements and specific metrics

about that. Then, to a large extent, at that point they turned the contractor loose. DOE has spent relatively less time thinking about performance metrics and what it wants to buy, and relatively more time in day-to-day management of the contractor, which leads to issues about scope control, change management, and other things. Then, all of a sudden, a few months later the project is different than it used to be and nobody has really been keeping track.

Another key thing is for the organization to understand when it is behind something and when it isn't. DOE has had a long track record of starting \$100 million plus projects and not getting them done. Some of these projects are thrust onto the agency. We get a lot of help from Capitol Hill, which says, "We would like you to do this project." Yet I can almost guarantee you if the DOE organization hasn't decided a project is of utmost importance, it will be gummed to death over time. Probably when its sponsor retires from office, the project will just fall off the end of the table, much to the chagrin of contractors who have been eagerly proposing on said project.

I think it would be good for the department to have some way of communicating with Congress to say whether we need to do a given project and determine if we are going to be behind it or not.

Another example is when a sponsoring entity inside the organization comes up with something and then initiates it under the cheap-to-study-but-too-expensive-to-build mode. If you look at the environmental programs in the early 1990s, an overwhelming number of these fit into that array.

It is very cheap to say, "I want to build a vitrification plant." It is very expensive to actually build one. Almost every DOE site had a vitrification plant planned for it, and it was a very painful process extricating DOE from that way of thinking. So we have to do a better job of controlling the planning activities to make sure that we are not planning for projects or budgeting for projects that we realistically can't afford and don't have a funding mechanism for.

We have just revised our oversight structure and put all of our non-Inspector-General-related safety and security oversight into one entity that reports to the Secretary. We have agreement that headquarters oversight should be on DOE in the field, not on the contractor. This means that we should only be sampling the contractor to see if the DOE contract management organization is in fact behaving appropriately in its relationship with the contractor.

The problem we have had up until now is we have lots of oversight and it tends to focus on the same thing. It goes right down to the shop floor and doesn't address systemic management issues between the shop floor and my level. So I am anxious to see how a whole array of different behaviors may unfold through the change of that role.



Robert G. Card was sworn in as undersecretary on June 5, 2001. As undersecretary, he is responsible for DOE operations in energy, science, and environment.

Prior to his selection as undersecretary, Mr. Card was president and CEO, Kaiser-Hill Company LLC. In that role he was responsible for the \$7 billion, 5,000-employee cleanup and closure of the Energy Department's Rocky Flats, Colorado, site. The plant was formerly one of the nation's five primary nuclear weapons production sites.

Mr. Card also served as a director and senior vice president at CH2M HILL Companies Ltd., which had revenues of about \$2 billion and was one of the world's larger science, engineering, construction, and operations firms. The corporation had major practices in the areas of energy and environment, water, transportation, and industrial manufacturing. Prior to the Rocky Flats assignment, Mr. Card served as group executive, Environmental Companies, responsible for the energy and environmental business, which was the firm's largest business practice. This business served a variety of customers, including the federal government, electric utilities, oil and gas companies, and other industries.

Mr. Card completed the Program for Management Development at Harvard Business School and received an M.S. in environmental engineering from Stanford University and a B.S. in civil engineering from the University of Washington.

3

DOE Project Management Accountability and Process Improvement

*Bruce M. Carnes, Chief Financial Officer
U.S. Department of Energy*

In many ways DOE projects are unique in that they combine R&D with conventional construction in such leading-edge science projects as high-energy laser facilities and neutron sources. Additionally, many of our environmental cleanup projects also have R&D elements, and we are attempting to clean up one-of-a-kind mixtures of radioactive wastes. Yet other projects are similar to those of other governmental and private owners, things like computing facilities, infrastructure repair projects, and office buildings. What this means to us is that there is no one-size-fits-all for our approach to projects. Rather, our project improvement efforts provide an outline that can be tailored to each project depending upon its size and complexity.

We are interested in the what, not the how. Too often we try to tell people how to do the job. We need to tell the people less how to do it and be very certain that we are defining well what it is that we want done. One of the important reasons for involving the private sector is that the private sector brings ingenuity, creativity, and imagination to these tasks.

One initiative now under way is improving our selection process or our validation process for proposed new projects. We are building a better process to align proposed projects with the department's mission areas, and we will do this in two ways. In the short term we will conduct an independent assessment of each proposed new project to advise the decision maker how well the project satisfies and aligns with the department's mission areas, whether that be stewardship of the nuclear stockpile, an initiative related to the national energy plan, a nonproliferation effort, a science project, or a cleanup effort. We intend to

provide the decision maker with an unbiased evaluation of that alignment, so that we can focus our efforts where they need to be focused.

Within this coming year, we will have the capability to have a multiyear program of projects. That way we can look at relative priorities, relate those priorities to need dates, and arrange the budget so that we have an affordable year-by-year program. The Department of Defense calls this planning, programming, and budgeting, and they use it to build a future year's defense program. We are going to do that at Energy.

One of the first things I noticed coming to the Department of Energy is that we did not have what DOD refers to as a program analysis and evaluation (PA&E) function, and we are creating that function. It will take a multiyear look at what projects mean to us in the future, that is to say, we need to know when we start a project what it means for us 5 years out. It is great to have great ideas. But before we launch we need to make sure we know where that great idea is going, where it is going to end up, and what it is going to cost. That way we can have a balanced portfolio and we can actually manage to get there. I have already committed the resources to implement both the short-range effort and the multiyear program.

This PA&E entity has four primary functions: (1) to develop and maintain our strategic plan, (2) to guide the department through the planning, programming, and budgeting process, (3) to manage the Government Performance and Results Act efforts, and (4) to conduct ad hoc program management studies for the secretary and deputy secretary.

Another initiative is greater emphasis on acquisition planning. The Federal Acquisition Regulations (FAR) require acquisition planning. The acquisition plan takes the defined project and evaluates and proposes the game plan to show how the department will acquire the capability we are seeking. Acquisition planning includes such things as business approach, technical requirements, risk identification, assessment and management, life-cycle costs for alternatives, and the contracting approach. An IPT, an integrated project team, should create this plan at the site, with headquarters involvement as appropriate, but only as appropriate, and tailor it to the size and complexity of each project. Our new initiative here will provide an independent look by my office at each plan, to provide an unbiased quality check of the plan. The deputy secretary has approved this policy and will be issuing this week a memorandum which will confer upon the undersecretaries an acquisition planning and approval authority that they have not heretofore had. They will have authority to approve projects within certain dollar range limits, and others beyond that will involve the deputy secretary as well.

One of the things that we have done in the department under this administration is to confer line management responsibilities on our undersecretaries. We are involving them in this approval process. This is going to be a lot of work, but it does establish a line of responsibility and accountability that the secretary and

the deputy secretary feel very, very strongly about. A designated decision maker must render key or critical decisions at the entry phases of each project. Critical decision 0 determines that the project is in fact supportive of a departmental mission. Critical decision 1 authorizes the start of design with the project engineering and design fund, a fund that was just implemented last year. Critical decision 2 approves inclusion in the department's budget. The Office of Engineering Construction Management now validates the budget and schedule at this critical decision for the decision maker. Critical decision 3 authorizes the start of construction or fabrication. The idea behind these critical decisions is that the project manager must demonstrate to the decision maker—that is, to include certain independent validations—that the project is ready to proceed. The National Academy, in their 1999 report, was very critical of the department for not performing this function. I believe we have fixed that problem.

A second practice we borrowed from industry is that of periodic project performance reviews. We require the project manager to review the status of each project with that same decision maker either quarterly or monthly. This was not standard practice in the department until last year. The length of these reviews varies from project to project, depending upon size and complexity. It could be 15 minutes; it could even be an hour if necessary. But the point is we are doing them and learning how to manage better. My office participates in all the reviews of the larger projects, to help round out the capabilities of the review.

A third improvement is a standard project reporting and status system. Unlike our brethren in DOD, in the Corps of Engineers, or the Naval Facilities Engineering Command, we at DOE did not have a standard system until now. With accurate information, our managers at all levels will have a much better capability to influence projects. We issued the first report, which resembles a traffic light in that it gives red, yellow, green indicators of significant projects, so that senior managers in the department can see whether projects are on track against a variety of criteria. If you see a yellow or you see a red, you can drill down and find out what is going on and causing a problem. It is not sufficient to wait until something blows up to find out what happened.

The Project Analysis and Reporting System is facilitated by the required use of earned value management as part of the project controls used by our contractors for all projects over \$20 million. We believe that the use of this standard and well-accepted tool will help all our managers, both contractors and federal project managers, to see what is happening in real time and be able to better influence outcomes.

Fourth, the President and this administration are committed to better measurement of performance, awards for good performance, improvement of not-so-good performance, and accountability. What I've outlined above provides the metrics we need to better oversee our projects as the owner. Critical decision 0, once it is approved, tells us that we need to expend resources. The acquisition plan is the game plan, so we know where we are going and how we will approach

the acquisition. Validation of the budget and performance baseline parameters will build credibility with Congress and give us more attainable targets. Use of project controls and earned value management will give us the tools to manage better and solve problems earlier, as well as serve as a performance metric. And the reviews and reporting will provide the project managers with a vehicle to inform senior managers. This will enable our senior managers to see how things are going utilizing predefined metrics.



Bruce Carnes was nominated by President Bush and confirmed by the Senate as chief financial officer for the Department of Energy in the spring of 2001. In addition, he serves as director of the Office of Management, Budget and Evaluation, in charge of the DOE's budget, finance and accounting operations, human resources, acquisition, and program and project evaluation.

Prior to that, Dr. Carnes was deputy director of the Defense Finance and Accounting Service (DFAS), a nearly 20,000-employee agency responsible for the Defense Department's worldwide financial operations. In this position, he functioned as the agency's chief operating officer, overseeing DFAS's budget, human resources, acquisition, and planning activities and the finance and accounting operations of the Department of Defense. Dr. Carnes came to DFAS in 1993 from the Office of National Drug Control Policy, Executive Office of the President, where he served as director of the Office of Planning, Budget and Administration and briefly as acting director.

Dr. Carnes entered federal service in 1976 in the U.S. Office of Education, in Washington, D.C. In 1979, he joined the National Endowment for the Humanities as assistant director, Office of Planning and Policy Analysis. He later assumed the post of director, Office of Planning and Budget, managing the development of overall agency program policy, budget, legislative proposals, congressional testimony, and agency management issues. In 1985, Dr. Carnes was nominated by President Reagan and confirmed by the Senate as deputy undersecretary for planning, budget, and evaluation in the Department of Education.

Dr. Carnes has a B.A. from the University of Colorado and an M.A. and a Ph.D. from Indiana University. Prior to joining the government, he was an assistant professor of English at James Madison University, Harrisonburg, Virginia.

4

The Elements of Project System Excellence

*Edward W. Merrow, Founder and President
Independent Project Analysis, Inc.*

The three companies here today saved literally hundreds of millions of dollars during the 1990s by improving their project systems. What are the common elements they share? What are the things that have moved them forward?

In DuPont's and Chevron's case, they have found areas of true excellence. Weyerhaeuser has gone from being less than mediocre to being very solid and is on its way to becoming excellent. All three companies have lowered the capital cost of their projects. All are providing excellent operability of plants, something that has not really been mentioned very much. But the fact of the matter is, developing facilities that don't operate very well is not much better than developing a facility you shouldn't have built at all. Most importantly, all three of the companies represented on the panel have project systems that are responsive to their businesses. By that I mean the businesses provide direction, the businesses say this is what we need, and the project systems respond with the right project done well.

All three of these companies used to be underperformers. I'll never forget when I first benchmarked DuPont, their projects proceeded in an expensive, slow manner but things worked at 200 percent of nameplate. And it was predictable. But with schedules and costs like that, anybody would be predictable. So a lot has changed at DuPont, at ChevronTexaco, at Weyerhaeuser. What are the key common elements they share? First, all three companies adopted a common process (Figure 4-1). It isn't just a process for process's sake. All three companies realized they needed to have a consistent and enforceable approach to projects, and they needed to have their own vocabulary. They needed to understand across all of the functions what things meant. At DuPont, when you talk

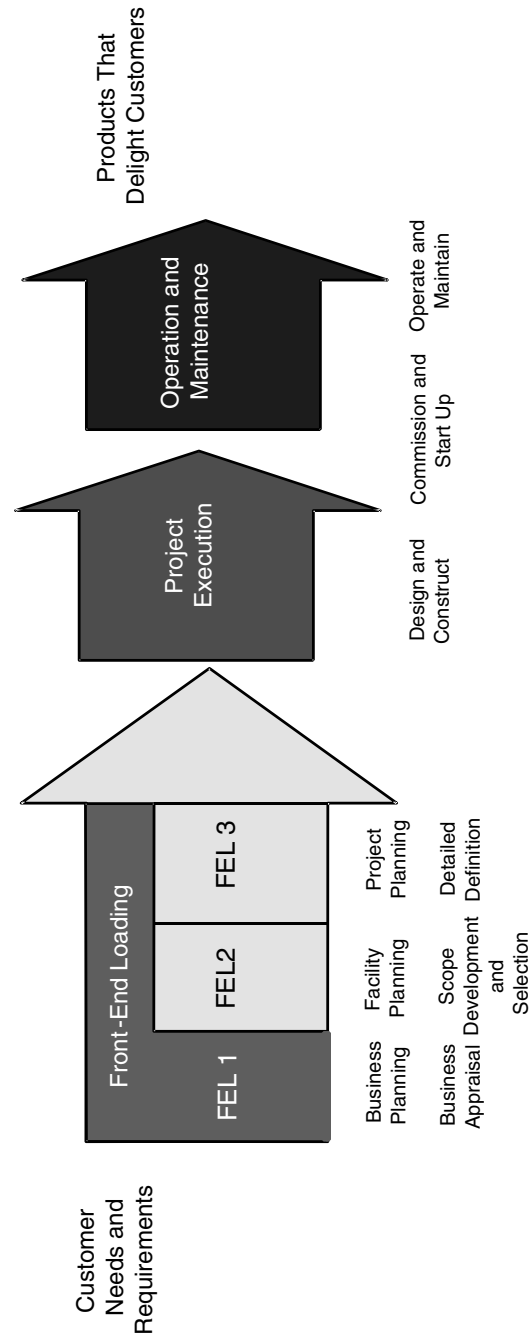


FIGURE 4-1 Common process.

about FEL 1, everybody understands it is business planning. Everybody understands, because they have a common language.

One of the critical things that is problematic in project systems across the industry is the lack of cooperation across functions. The businesses don't understand the engineers, the engineers don't understand the contractors, operations doesn't understand anybody. These three companies have a common language for talking about projects. The substantive work of their project systems is defined by their common project process. They also view their common processes as a controllable, manageable process. When people at all three of these companies think about control of the project system, they think of it in terms of statistical process control or statistical quality control, much as they think about controlling and improving a manufacturing process.

They understand the relationship between inputs, or things that feed the project process, and results. Because they understand the relationship, they can manage the project system via the front end.

Project systems by their nature, and especially major project systems, cannot be managed by results. Management by results is a good management consulting phrase, but it is absolutely hollow when it comes to projects. Projects must be managed by the leading indicators.

The critical leading indicator revolves around the front end (Figure 4-2). All three of these companies and other companies that excel in capital projects in the process industries are focused on the front end. And in one way or another, the front ends of all three projects systems resemble each other in their fundamentals.

First they try to define what they are trying to do. That is the business front-end loading. For DOE I don't think it is basically any different. What is the fundamental objective? Not, what is the project? In fact, the most capital-efficient project is the one where I can meet the business need with no project at all. One of the characteristics of these companies is they look for that nonproject alternative as part and parcel of their project system.

Second, they have a steadfast commitment to excellent definition. They ask if that opportunity is real and what is it going to look like. Then, finally, they endeavor to work out all the details of how they are going to do this quickly with no change. Why this incredible emphasis on the front end? Let me put a couple of numbers around it. In the process industries—all chemicals, minerals, pulp and paper, steel—only about one project in five meets all of the project objectives promised to the company at authorization. That may surprise you. I think a lot of people have the view that vis-à-vis the government, the private sector does everything well. The bad news is four projects in five don't meet all the promises that they make. The product costs more, the process doesn't work as well, and people get hurt on the project. The good news is that the percentage of projects that meet expectations is up from about 6 percent 15 years ago.

Among projects that had completed the front-end work, how many projects failed to deliver? Two in a hundred. In other words, most projects do not go

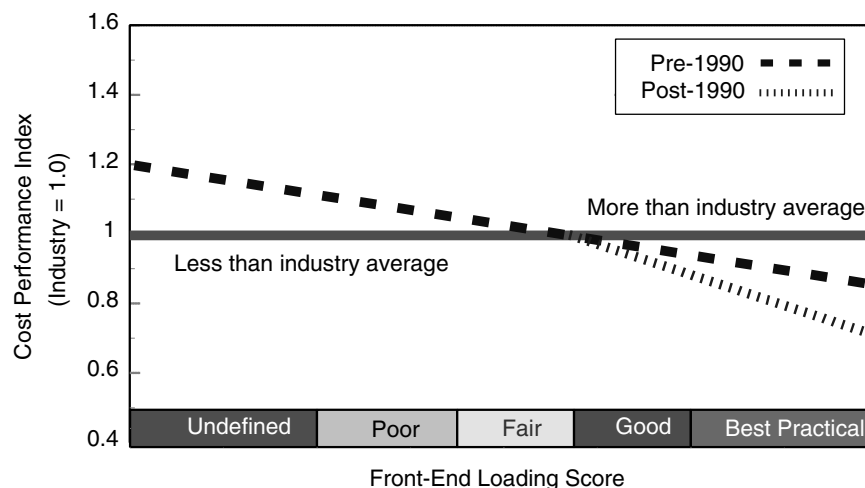


FIGURE 4-2 Front-end loading drives cost.

astray in the field. Most projects do not go astray when we get into detailed design. The projects go astray up front. Almost all field problems can be traced back to things that we failed to do on the front end.

There is not a dichotomy between selecting the right project and doing the project right. Those two things go together. Front-end loading answers the basic questions for the owner: Why are we doing it? What are we going to do and when? How are we going to do it? Who is going to do the work? All of those questions have to be fully answered on the front end if they are going to be successful. It is one of the first orders of business. Front-end loading is a process, but it is also a set of products. It is very important to focus on the products when measuring front-end loading. It provides the basis, the platform, for doing the value-improving practices. It produces a design basis package, which is the basis for no change. It also gives you a baseline that you can honestly measure against and not a baseline to be rebaselined next year. In addition, it provides an enduring set of commitments made by the project organization to the business around project quality. It allows business, operations, and engineering to align their functions.

Finally, a poorly planned project is inherently a project that is at risk for safety problems. Front-end loading in the process industries is the vehicle for cutting out cost. Interestingly, we have seen that the relationship between front-end loading and reduction of cost has actually gotten steeper in the 1990s than it was in the 1980s. It is also the way that you take time out of construction, because front-end loading is fundamentally the way that you eliminate unnecessary change.

The goal of projects is not to have zero change. It is like what that much maligned baby doctor, Dr. Spock, used to say: If your goal is to never spank your children, you will probably spank them just about the right amount. Well, that is true with change as well. Our goal should be no change, but we will make changes, particularly in high-technology projects. And the high-technology projects are also the ones where it takes more owner muscle and involvement to make them go. Those are the projects that are very difficult to effectively pass to a contractor to simply execute according to plan.

In the private sector, the part of the front-end loading process that is done worst is trying to figure out what it is that you want to do. Sometimes after a project has failed because the price and volume forecast were wrong, business people will say: You can't forecast the market. Our response is that's your job and if you can't do it, you need to find somebody who can. The fact of the matter is, if you do the diligent hard work in this first phase of front-end loading, you will have many fewer market surprises.

Most project systems are pretty good at this middle step, FEL 2. This is how you take an idea—good, bad, or indifferent—and turn it into a scope of work. Many people think that front-end loading is over at this point. It's not. The third piece of front-end loading, FEL 3, which is the project planning, involves figuring out exactly how you are going to do this thing. You must ask: Do we have the right contractors on board? Is our approach to contracting correct? Do we know how we are actually going to start it up and who is going to do that work? Do we know how we are going to turn units over? All of this is planning work that must get done before you are ready to execute the project with excellence. This is the area that is the second area of weakness in the private sector in getting the front end done correctly. One of the things that I hope is clear from the presentations of my colleagues this morning is that the owner must have sufficient internal competence to control the front end of a project. And when I say control, I mean to really shape it. That means that you can't eliminate all technical competence from the DOE organization and still have good projects. You must have technical competence in order to be able to do your projects well. You must be able to control the development of that front end and you must be able to control it right through the execution planning.

Contractors can do a lot of the heavy lifting, especially in FEL3. But contractors cannot figure out what you should do. They cannot figure out why you are doing it. They can't figure out the details of how you are going to do it. And the more technically complex the project is, the more owner involvement is critical to the success of the project in execution. All this is for a very simple reason. There is no such thing as a high-technology project that does not have required changes in execution. It is a red herring, a fish that doesn't exist. Changes will be required, because if we knew everything going in, it wouldn't be a high-technology project.

A weak owner combined with a good contractor makes a bad project. Therefore, strength in the core competencies of the owner is absolutely essential to the development and execution of a capital-effective project, be it in the private or the public sector.

To sum up, first and really foremost, you have got to get the various parties aligned around what you are trying to do. You've got to use competitive technology or you are obsolete before you get out of the starting gate. You have to use the value-improving practices. And most importantly, you have got to front-end load, front-end load, front-end load. For real estate it is location and for projects it is front-end loading. The result, then, is the right scope to meet the business needs. You must get your contractors and your vendors involved early enough that they, too, understand what you are trying to do. You execute with discipline. The result is low cost, fast cycle time, and good quality.

Now interestingly, in all three systems safety and better returns on investment are coequal goals. It is absolutely essential I would argue, because part of what makes good safety is found back here on the front end, and you simply can't avoid it. So if project excellence is so simple, Why—as the chairman of one of the big four oil companies asked me a couple of months ago—can't we do it? It is obvious, but why don't we do it? My answer to him, and I think an answer to almost all companies that have serious performance problems around their capital project system, is because you can't develop the necessary level of cooperation within your organizations to do the job right. That is the single most difficult element of having an excellent project system. You have to all be in it together. There is no such thing as a good project system that belongs to the engineers. Every good project system belongs to the company, and to come full circle, this is why common process is so important. This is why, when the chairman says that the ChevronTexaco Project Development and Execution Process (CPDEP) is the corporation's process, that it is a core value, and that it is the way the corporation is going to approach its work, it really makes a difference. Without that cooperation, it is virtually impossible to ever be more than mediocre.



Edward Merrow is the founder and president of Independent Project Analysis, Inc., a company that provides a unique project research capability for the chemical process industries. Over the 14 years of its existence, IPA has grown from a one-person organization to over 100 project analysts with offices in the United States, Europe, China, and Australia.

After receiving degrees from Dartmouth College and Princeton University, Dr. Merrow began his career as an assistant professor at UCLA, where he taught mathematical economic modeling and industrial organization. After 4 years of teaching, he went to the RAND Corporation, where he developed and directed

RAND's energy program and research program for the chemical process industries. After 14 years, he left RAND in 1987 to start IPA.

Dr. Merrow has been active in the American Institute of Chemical Engineers as a panelist, panel chairman, and contributor to *Chemical Engineering Progress*. He has testified before the U.S. Congress in matters pertaining to overruns in major capital projects and served as a panel member for the National Academy of Sciences/National Academy of Engineering on the analysis of project risks. He was the 1998 recipient of the Construction Industry Institute's highest honor, the Carroll H. Dunn Award for Excellence. In 2001, he received the American Institute of Chemical Engineers Engineering & Construction Contracting Division Award for "outstanding contributions to the industry."

5 DuPont's Role in Capital Projects

*James B. Porter, Jr., Vice President, Engineering and Operations
E.I. du Pont de Nemours and Company*

ACCOUNTABILITY

In the DuPont organization, the owner/operator has four basic accountabilities in the realization of a capital project: (1) select the right projects, (2) lead the front-end loading process, (3) manage project execution, and (4) ensure competency renewal.

Selecting the Right Project

In order to ensure the right projects are selected, the company has developed an authorization flag process that requires the owner/operator to demonstrate that the project is supported by (1) DuPont's business strategy, (2) price forecasts, and (3) volume forecasts. It must also (4) show that the best technology has been selected and (5) have a sound plan in place to ensure project execution. The first four are clearly business issues about the "what." The last one is very much a "how." In our company your project does not advance if you can't express these in a way that makes business sense and at the same time can't convince people you are going to do this job in a very disciplined way.

Leading Front-End Loading

Front-end loading (FEL) is a term coined by the DuPont company some 15 years ago. It is a model that we have used over the years to help focus the people and develop the processes and the discipline. In essence, it means you define what it is that you want to do in such a way that the people who are going to do it can carry it out in the most business-effective way.

Figure 5-1 describes FEL's key elements and how they fit into DuPont's overall facilities engineering process.

Managing Project Execution

There are seven critical success factors in the DuPont project system. They are listed below, along with suggestions on how best to accomplish these ends.

1. *Set up teams for success.* If you don't have an integrated project team, you are not going to get the best out the other end. The teams have to be managed in a way that allows them to deliver their value to the process. Other suggestions: identify a project sponsor, develop business/project objectives, and assign experienced project and functional leaders to the teams.

2. *Manage the teams for success.* Use a steering committee. Reduce turnover in personnel, especially project managers. Define roles and responsibilities of team members clearly. Leverage core resources with contractors.

3. *Front-end load opposite business goals.* You can't put a bunch of engineers in the room and let them decide what it is that's going to be done. The business goals have to be the underpinning. In DOE's case, what the department's goals are have to be the underpinning. And, if you start to do things that are not consistent with that, you've got to stop. Also recommended: Have a consistent and documented front-end loading process. Follow the FEL process. Use gatekeeping between phases. And finally, don't authorize until FEL is complete.

4. *Use competitively superior technology.* Most projects take 1, 2, or 3 years to build. By the time you have it built, somebody else has a technology that is superior to yours. You've spent money on something that won't create value. Recommended steps: Benchmark others, especially principal competitors. Utilize disciplined technology selection methodology. Document basic data.

5. *Minimize the non-value-adding investment.* Use process simplification/value engineering and all applicable value engineering practices. Benchmark against industry averages. There is a lot of project management technology that can be used very effectively. But you have to get people knowledgeable about these practices—they have to have the authority to make them happen, and they've got to be disciplined in terms of how they apply them. Value-improving practices (see Figure 5-2) make a big, big difference.

6. *Ensure safety excellence.* You can't build something where people or the environment is going to get hurt. Consider process safety management, responsible care, process hazard analysis, and environmental assessments.

7. *Execute the project with no changes.* Once you start to change after your project is started, you are in trouble. You know what happens. Make a little change over here, somebody else has to change, before long the whole thing changes.

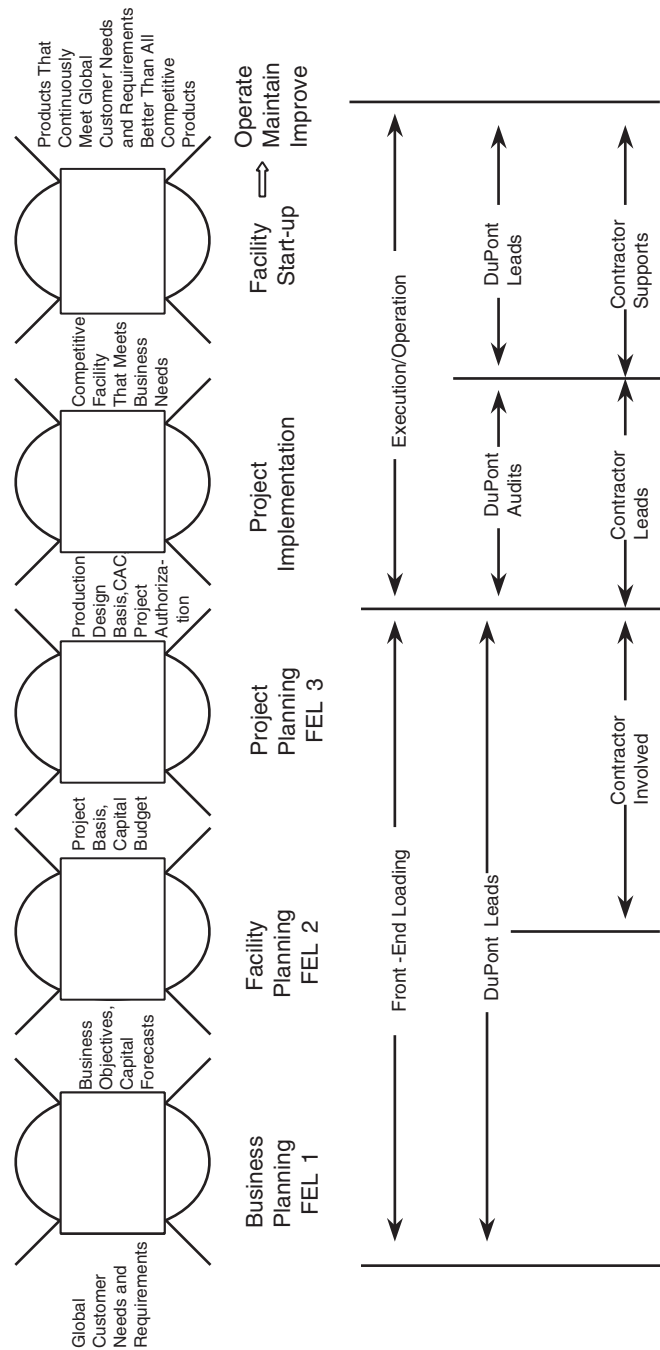


FIGURE 5-1 DuPont facilities' engineering process.

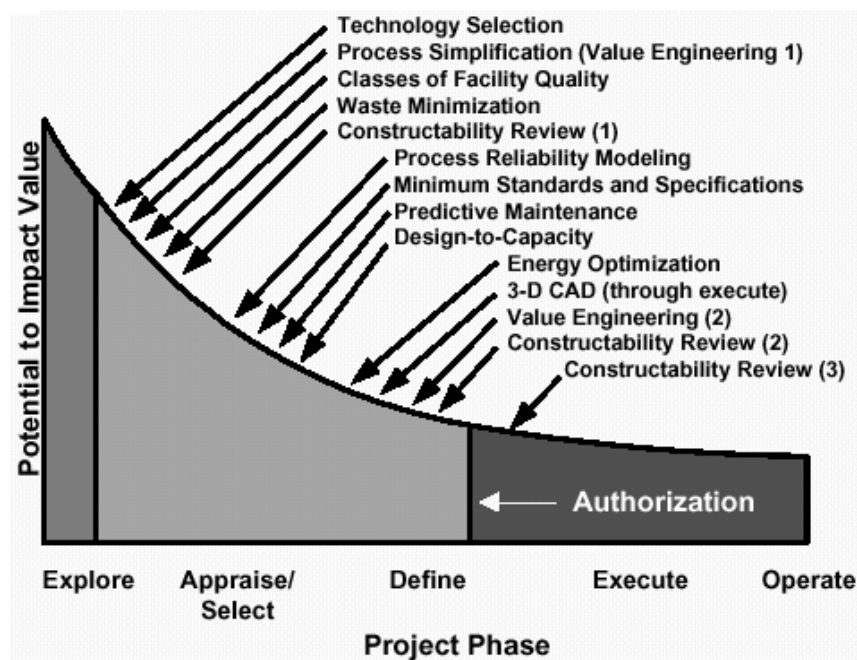


FIGURE 5-2 Value-improving practices.

DuPont built a project in Texas with less than 0.2 percent change in the steel and less than 0.1 percent in piping; it was a \$100 million dollar job that came in for \$65 million. It had 20 percent engineering design costs. If we had tried to authorize it at 20 percent engineering design cost, they would have said no and the job would have cost \$100 million, because nobody likes to spend that money on the front end. But the reality is, if you do the work right on the front end, you can save yourself a lot of money because there won't be any changes.

Best-practice tools in this area are authorization sign-offs, flag process, making sure FEL is complete, and cost management/cost control. Disciplined behavior is required to hold changes to an absolute minimum.

Ensuring Competency Renewal

You must take steps to ensure competency renewal. In my organization, the average age is 49 and last year it was 48 and next year it is going to be 50 if we don't change things. And at some point we won't have the competency that is required, so the owner really has an accountability to ensure that the competency survives.

The way we are working on that in our company is by setting up a position in every business unit that we call "business engineering manager." These people are proactive members of the strategic business units, and their job is within the business unit to make certain that the business gets what it needs in terms of competency to make the business competitive, and at the corporate level, to work as a part of a council or a network to make certain that the company has what it needs, because you can't renew a competency in a company like DuPont from the top. You can only do that within the business units.

CHALLENGES

DuPont faces a number of challenges in deploying capital in the most effective way. One is sustaining and renewing the engineering competency in a cost-constrained, changing business environment. Another is increasing the value added by leveraging technology and best practices in a decentralized managing model. I would suggest if you have learned how to do it well, that you can share it across other branches and other departments, so that everybody doesn't have to learn the same thing the hard way each time.

The cost trust portion of the curve in Figure 5-3 came from a Construction Industry Institute study, some years back, that actually took a number of projects

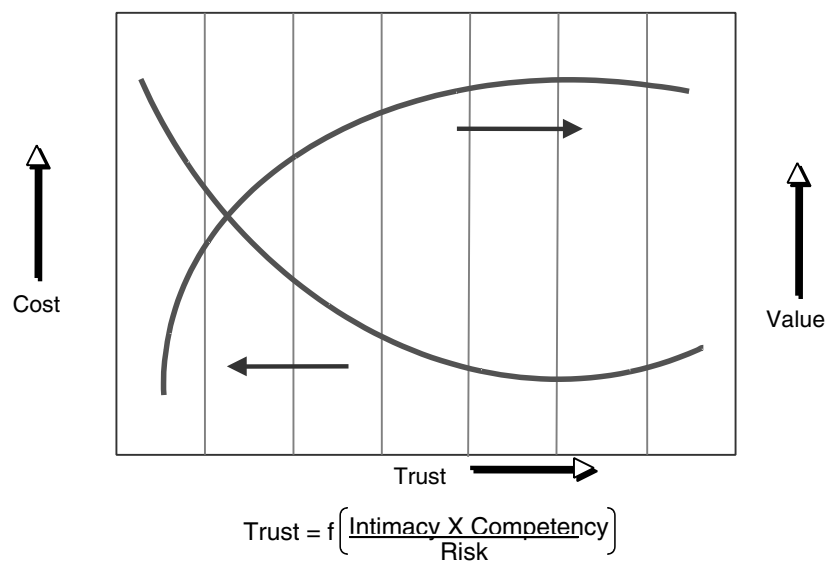


FIGURE 5-3 Competency/trust relationships.

and developed some empirical relationships. It said that where trust increases, as particularly in project management, the total cost goes down. Now I did a little turn-up on the end, because I tend to believe that you can trust me a little too far. If you trust me outside my competency range, it is going to cost you a little something.

The reality is that if you can improve the process and put in place ways for people to work together where trust is fostered, you are going to get less cost. What we are finding in the business environment is also true on the value curve. You create greater value where people learn better, learn how to work better together, don't duplicate work, and don't spend all their time trying to catch people doing wrong things, but spend a lot more time trying to catch them doing right things.

REFLECTIONS

Engineering has got to see business processes holistically, so the engineering organizations that we have in place are able to see the big picture. They can't just work in a narrow frame of reference. They have got to see engineering as a key component of their financial success. Best practices define the pathway, and to paraphrase DOE's CFO and undersecretary, the owner/operator leadership cannot be delegated. You've got to lead and you've got to stay focused on the what.



James B. Porter, Jr., was elected vice president of engineering and operations for E.I. du Pont de Nemours in early 1999.

He joined the company in 1966 as a chemical engineer at its Engineering Test Center in Newark, Delaware, and has held a number of positions in design and operations.

In 1990, he became director of engineering operations. In 1992, he was named director of operations for the company's fluoroproducts business. Three years later, Mr. Porter was appointed corporate director of operations. He also assumed the position of vice chairman of the DuPont Corporate Operations Network. He was named vice president of engineering in 1996.

In 2000, Mr. Porter served as chair for the Construction Industry Institute. Born August 21, 1943, in Knoxville, Tennessee, he received a bachelor of science degree in chemical engineering from the University of Tennessee in 1965.

6

Weyerhaeuser Capital Management Process

*Steven Harker, Project Benchmarker
Weyerhaeuser Corporation*

Weyerhaeuser is a 100-year-old forest products company. It is one of the first to have started reforestation and one of the first companies to really push the sustainable forestry initiative. In 1995, knowing that it had some problems in its capital system, the company started looking at different capital systems, among them being those presented today by DuPont and ChevronTexaco.

Independent Project Analysis, Inc., began working with Weyerhaeuser at this juncture. It highlighted three deficiencies in the company's planning process:

1. First, there was unclear business accountability. We had sawmills, structured wood, pulp and paper, and packaging operations. They all wanted to get money and do their own projects. But individual operations have an agenda that doesn't always correspond to corporate goals.

2. The second was that our capital allocation process lacked discipline. We had no set procedures.

3. Finally, there was a strong perception of a company demand for cost predictability. To get that you can inflate your estimates. So a lot of our projects ended up coming under budget. Everybody seemed to be happy, but they didn't realize that that budget was really inflated.

So the company built on the work that DuPont, Dow, ChevronTexaco, and others have done with IPA. Internally, we also did benchmarking to determine what we did really well and in what areas we didn't. Out of this grew a system we call Process to Achieve Capital Excellence (PACE). We use a front-end loading

index to measure how well we are doing in our front-end development of a project.

Weyerhaeuser doesn't use a lot of new technology, but we do well at using existing technology and enhancing it. We're also fairly good at keeping our people on board the projects. We find that important in making sure that our projects are successful. We have improved our use of value-improving processes on our different projects. We are still having some design changes.

We've made some significant progress in IPA measures of cost index through our process organization. Safety is a very core business and competency in the Weyerhaeuser Company, and we've made some pretty good improvements there, but we are not where we want to be in safety yet.

Again, you need to make sure you are doing the right project and then make sure you are doing the project right. You have to make sure that you look at both of those. We looked at what we thought was our opportunity in development of projects—that is, doing the right project. We felt like we had a 40 percent opportunity there.

For our larger projects, we feel it is very important to have owner representation. We have a project manager on board who is a trained project manager, who is involved 100 percent of the time. We have some in-house engineering. We also use outside engineering consultants. We've done well at having good team representation. On all of our major projects, we had 100 percent team representation.

We feel it is very important for the owner to take responsibility for project controls, and that includes the estimate review. We don't have a large in-house estimating department, but we have professionals who review every estimate that comes from the consulting firms and make sure they are validated.

We use various people for safety, but we feel it is very important to have them on board 100 percent of the time on our larger projects.

Some of our construction management is done in-house; sometimes we use consultants, sometimes we use a contractor. But we feel it is important to have that owner's representation in the construction management. At the same time we feel it is important to have operations and maintenance represented to provide their expertise and their buy-in to the project, since they will be there to operate it and run it. We typically have in-house procurement. We have contracts in place with people like BE&K and other engineering and construction firms so we don't have to spend a lot of time going out for bid all the time.

It used to be that gatekeeping was just kind of a pass-through formality, but now it is a more serious event. We have a CEO in Weyerhaeuser who takes it very seriously. He has an engineering background, so he understands that end of the businesses. He reviews every project over \$7.5 million at least twice. On the smaller projects we have an organization matrix where business leaders and vice presidents do that as well. We want to make sure that we are aligned with our business strategy.

When we do projects we want to understand what the key bets are for that project, what is going to be needed to make the project a success. One is always cost of the project. But it is the other key bets of productivity and other financial key bets that make it successful, and we make sure we track those. There is always the need for clear and concise decision making in our processes. Gate 0 in Figure 6-1 is very important for us. This is our strategic validation: to say that we have really aligned with our core businesses. For example, in the sawmill industry we decided we wanted to look at getting more recovery out of our logs to lumber, because the curved sawing technology was out there.

But you want to make sure that you are not overspending. If the idea is to get more yield, do we also want more production? How does that affect the other businesses? It used to be that the solid-wood side and the pulp and paper side were separate businesses. They didn't really talk together. So here we are putting in curved saws, and we are actually reducing the number of chips going to our pulp mills. With the PACE process we were able to understand what the impact was on that. At the same time we have less sawdust to go to our energy units where we make steam and electricity. So the PACE process (Figure 6-1) helps to look at the overall strategy of what you are doing, its effects, and how each project will also affect other business areas and other projects.

Phase 1 is opportunity analysis. We look at how we develop the business strategy into an opportunity and look at different alternatives. Phase 2 is feasibility, where we are now putting our financials in place for these different alternatives and we are going to surface the best alternative that meets this business need. Phase 3 is our proposal development, where we are putting more project definition together. This is more of your engineering-type function at this time. Phase 4 is the implementation, and phase 5 is the initial operation assessment. Phase 5 is about a year after our original start-up, so we can go back and assess how we did on the project and report back.

The strategic gates are gate 0, the point of strategic validation, and gate 3, the appropriation request. The first three in Figure 6-1 are the front-end loading areas, and then the execution of the last two phases that we have, high leverage gates. Our CEO is the decision maker at gate 0 and gate 2 for larger projects. We only have about 10 to 15 of those a year. For projects over \$20 million, it is a board of directors' decision and the CEO reviews every gate. We don't want to have the project completely designed before authorization at gate 3, but we need to have enough to be able to develop a good estimate and a good schedule.

Value-improving practices are an important process in projects. We focus on three: (1) technology selection, (2) process simplification (or, how can we make it easier to maintain?) and (3) how can we make it more effective? Other questions are, What is the quality we are looking for? Are we looking for a 20-year life or a 10-year life in each facility, in each area? We spend a lot of time on the constructability reviews here as well.

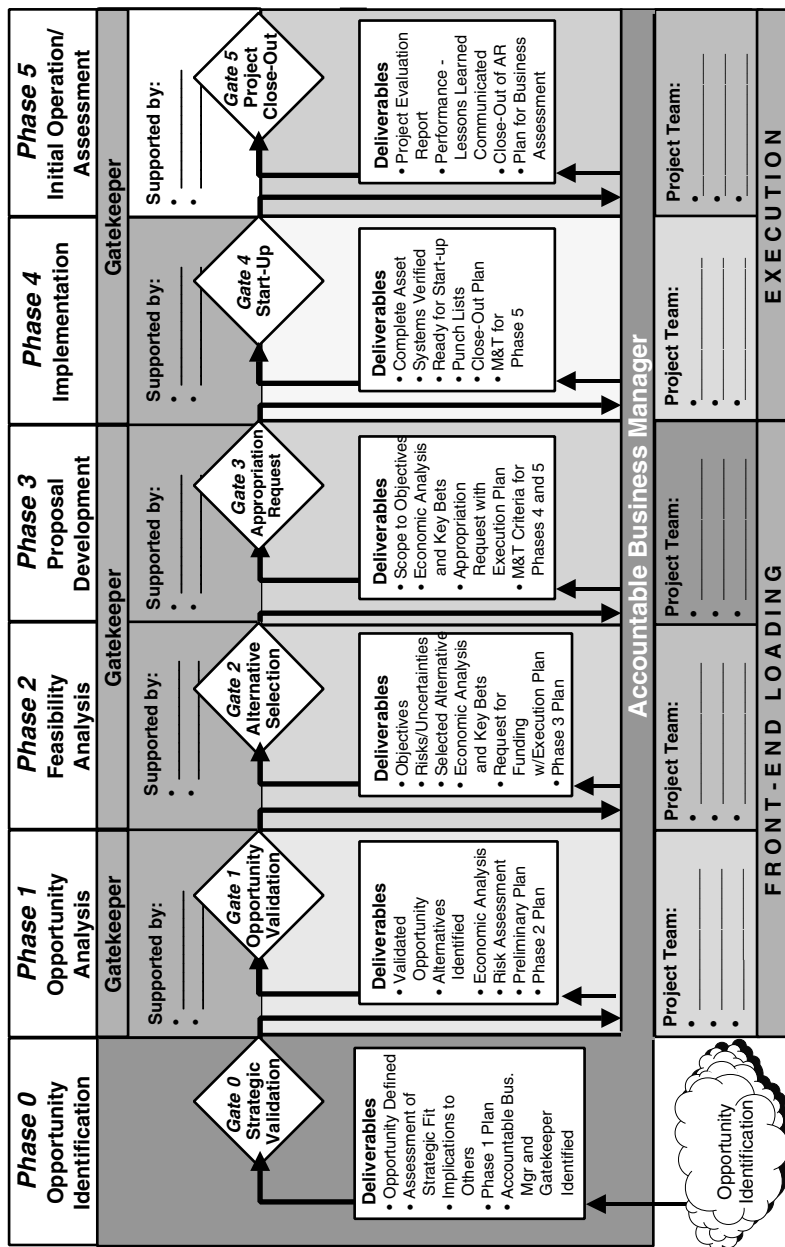


FIGURE 6-1 Overview of the PACE process.

We feel we are about halfway in our journey. We've made some significant changes. It is not easy. We bring new businesses on and we've had mergers and acquisitions. By the way, they follow this PACE process as well. There is also a phase-gated process whenever we're buying and selling new timber or facilities.

We've made great efforts in reducing our costs in the execution, as well as making sure we are doing the right projects.



Steve Harker is the project benchmarking manager for Weyerhaeuser Corporation. He is an electrical engineering graduate of the University of Utah. He started his career with General Electric. His responsibilities include project definition at the beginning of the projects, collecting the data, and coaching the project teams. He is a licensed professional engineer in California.

7

ChevronTexaco Project Development and Execution Process

*Joe Gregory, Projects Coordinator
ChevronTexaco Project Resources Company*

ChevronTexaco has spent much time and resources developing what it believes is a world-class project system. The roots of the ChevronTexaco Project Development and Execution Process (CPDEP) go back to the 1980s, when the company had what it thought were good processes and good projects. It started looking at ways to determine if these projects were in fact leading projects. Chevron's CEO at the time, after seeing the results of benchmarking, said it was a very dark day whenever the project we all felt was stellar turned out to be one that was very poor compared with industry averages.

Is everybody effectively utilizing the process within ChevronTexaco? The answer is no. Before Texaco joined Chevron, the company had many challenges, and one of those was just getting people to use the process, to believe in the process, and to see the value that the CPDEP process could bring to the company.

PROJECT RESOURCES COMPANY

In 1997 Chevron formed a group called Project Resources Company, which I am a member of. Within Project Resources, we have project professionals assigned to specific projects within strategic business units. Project Resources also has a shared services group made up of professionals who consult with project teams and business units to assist in meeting their objectives. Project Resources is the owner of the CPDEP process, entrusted to create and deploy tools and systems across the company.

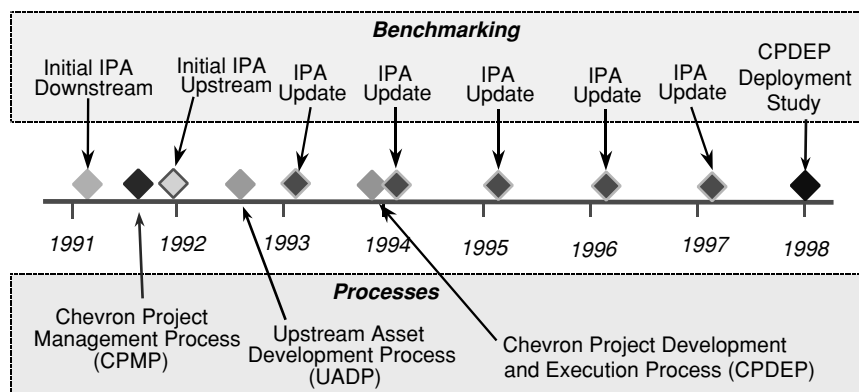


FIGURE 7-1 History of CPDEP/benchmarking.

BENCHMARKING

As mentioned previously, benchmarking is one way to look at your project management process to see how effectively you are performing. ChevronTexaco utilizes the services of Independent Project Analysis, Inc. (IPA) as a partner in benchmarking our projects (see Figure 7-1). IPA looks at how well we are doing at front-end loading, cost and schedule (before and post execution), and other key project attributes such as use of multifunctional teams.

BENCHMARK POSITIONS

IPA also reviews our projects for strengths and vulnerabilities and provides specific recommendations to improve project outcome. Utilization of IPA is just one of several processes instituted within the company to improve project performance.

The numbers in Figure 7-2 apply to Chevron, not Texaco. The downstream organization (Refining and Chemicals), which is a smaller group within Chevron than the upstream (Oil & Gas Exploration and Development) organization, took the CPDEP process and benchmarking to heart early on and improved its performance in cost and schedule.

In the upstream, where we spend significant portions of our corporate capital, we had both cost and schedule challenges to deal with. The upstream had very good schedule performance in 2000, but you can see from a cost perspective that we were not doing very well compared to the industry average.

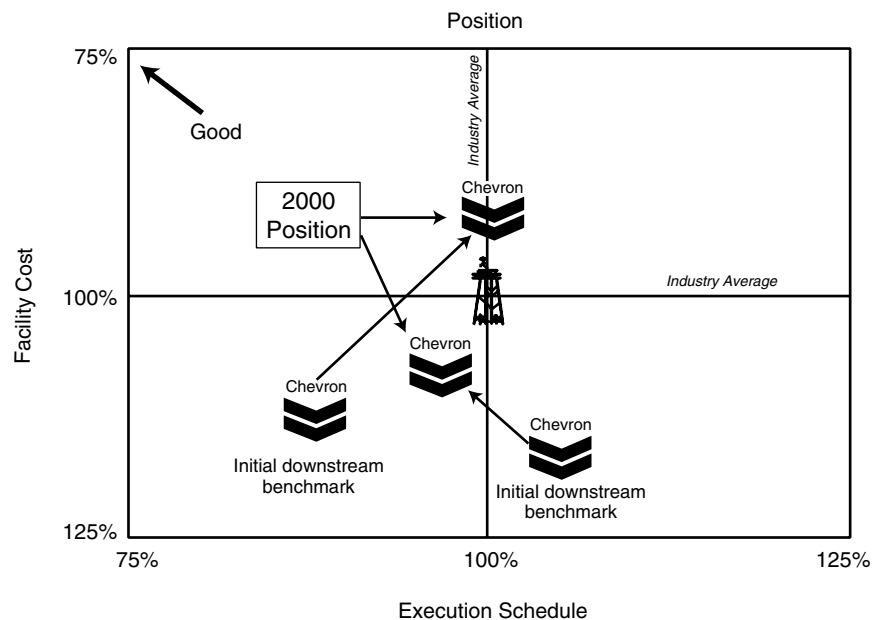


FIGURE 7-2 Benchmark position 1992 to 2000.

CPDEP BASICS

What are the principles of CPDEP? Basically there are five. There are value drivers; multifunctional teams; communication; being decision driven, not activity driven, especially early on; and consistent use of and sharing of best practices, tools, and lessons learned. Many times when you look at our lessons learned database within ChevronTexaco, you will see a recurring theme, or lesson learned. It is our intent within ChevronTexaco to continue developing a culture, not only to go out and seek those best practices and lessons learned, but to utilize them as well.

CPDEP seems pretty easy. It is classical gap analysis. We are looking at where we are today. We want to know where we want to be, and we are going to ask a very simple question: How are we going to get there?

Our focus in Phase 1 is clearly framing the goal (see Figure 7-3 for the five phases). We look for key boundary conditions, those that are from a corporate financial perspective, a project perspective, or other key stakeholders' perspectives. This latter view is valuable when we are working in international environments or with joint venture partners. As far as definition of success, we really want to know not only where we want to go, but also what success looks like when we get there. Phase 1 also includes an effort to build a customized project

1	2	3	4	5
ASSESS AND IDENTIFY OPPORTUNITIES	GENERATE AND SELECT ALTERNATIVE(S)	DEVELOP PREFERRED ALTERNATIVE(S)	EXECUTE	OPERATE AND EVALUATE
<p>OBJECTIVES</p> <p><i>Clearly frame goal.</i></p> <ul style="list-style-type: none"> • Identify opportunities. • Test for strategic fit with business objectives. • Preliminary assessment of uncertainties, potential return, and associated risks. • Plan for next phase. 	<p>OBJECTIVES</p> <p><i>Generate alternatives.</i></p> <ul style="list-style-type: none"> • Reduce uncertainty and quantify associated risks. • Develop expected value for selected alternatives. • <i>Identify preferred alternative(s).</i> • Plan for next phase. 	<p>OBJECTIVES</p> <p><i>Fully define scope.</i></p> <ul style="list-style-type: none"> • Develop detailed execution plans. • Refine estimates and economic analysis to A/R level. • Confirm expected value meets business objectives. 	<p>OBJECTIVES</p> <p><i>Implement execution plan.</i></p> <ul style="list-style-type: none"> • Finalize operating plan • Collect, analyze, and share metrics and lessons learned. 	<p>OBJECTIVES</p> <p><i>Monitor performance.</i></p> <ul style="list-style-type: none"> • Benchmark performance against objectives and competitors. • Share results and lessons learned. • Continue performance assessment and identify opportunities.

FIGURE 7-3 Objectives and key activities of the phases.

roadmap and project execution plans to help us achieve our goals more effectively.

During Phase 2, we focus on alternatives. The second phase is very critical. By bringing multifunctional teams together, we are able to look at many alternatives that will in fact grow value for the company.

In Phase 3 we take the selected alternative into front-end engineering to develop the scope and contracting plan prior to Phase 4, execution. Execution is definitely the fun phase for most. Phase 4 is where we see all of our efforts materialize. During Phases 3 and 4 we plan for an effective turnover with our operations, CPDEP Phase 5.

In summary, the first few phases of CPDEP are described as the value identification phases, the most critical of all phases to ensure maximum value for ChevronTexaco.

CORPORATE APPROPRIATION PROCESS

Our corporate appropriation process continues to evolve, especially with the addition of Texaco to the Chevron group. Projects over \$25 million must be reviewed by our executive committee, typically at the end of Phase 3. Key processes within the capital approval process include use of decision review boards, peer reviews, and project execution planning.

Decision Review Boards

Decision review boards (DRBs) are made up of key decision makers and include key representatives from within the SBU and generally at least one person from a different business unit. DRBs bring into our culture accountability. Not only is the project team accountable for project results, but the DRB representatives are also accountable for the investment outcome. DRBs are responsible for ensuring that the amount of work completed in that particular CPDEP phase is sufficient to move forward into the next project phase. DRBs are accountable for bringing in lessons learned and best practices, as well as challenging the project where appropriate to drive performance. DRBs are led by a decision executive who communicates business strategy to the project team; verifies that project drivers are aligned with business strategy; and endorses, recycles, or kills project team recommendations.

At a minimum, project teams will hold a DRB meeting at the end of each phase. That does not, however, mean DRBs are only engaged at the end of each phase. One phase may last 1 year or 2 years or even longer, and it is expected that DRBs will be engaged throughout the process, meeting on a regular basis with the project team as warranted. Project team and DRB communication is critical to ensure alignment and improved project performance.

Peer Reviews

A peer review is a process whereby subject matter experts perform a review of a project's underlying assumptions, decision logic, alternatives, and forward plans to validate and constructively challenge information in the decision support package (DSP). A peer review team will consist of 6 to 10 subject matter experts, usually from within the corporation. Peer reviews focus on the following key areas: commercial; decision quality; organizational structure of the project team; health, environment, and safety; project execution; and technical. Peer review members look to challenge the project team, to make sure they have done an appropriate amount of work to characterize not only the project but the plan for its success.

PROJECT EXECUTION PLANNING

Project execution planning (PEP) is one tool we use within ChevronTexaco to try to bring all of the project components together for communication to our stakeholders. We look to answer the "who, what, why, when, where, and how," in order to cultivate a team environment with a focus on achieving results. Project execution planning is an evolutionary process that lives within each of the CPDEP phases.

I would like to leave you with a few thoughts on success planning and ChevronTexaco's multiphase project management process. At the very beginning we look for a vision of success. Success planning within the CPDEP process is focused on looking at critical activities that need to be completed in that particular phase before moving on to the next phase. There are success factors critical to every project, and we try not to get ahead of ourselves and do more work earlier than we really need to accomplish a particular phase of the project. Success metrics are something that we take very seriously within ChevronTexaco. We look at both leading and lagging metrics, and we try to establish them very early on with our decision makers.

ChevronTexaco is all about selecting the right projects and executing them well. We want to be able to do more with our resources as an energy company than our competitors. We also want to execute our projects safer, faster, and less expensively than our competitors. Only through benchmarking our results and benchmarking our processes have we been able to see some light at the end of the tunnel.

We are pretty proud of our investment results. However, I want to mention that we have projects within our database with less than stellar performance. In reviewing the project results, we found these poorly performing projects did a poor job in front-end loading. If we had at least achieved industry average in those projects, we would have saved over 7 percent in cost, and that doesn't take into account the schedule problems that we endured. Just take 7 or 10 percent of

a \$5 billion capital budget a year: \$500 million would go a long way to provide the resources to fund additional projects for ChevronTexaco. We are serious about improving our performance in cost, schedule, reliability, operability, and safety.

TAKEAWAYS THAT I WOULD LIKE TO LEAVE WITH YOU

- Safety demands attention and ownership. If you delegate safety to the contractor, you are doing yourself, as well as your contractors and all those employed, a disservice.
 - Focus on decision making and executing.
 - Benchmarking can be used as both a leading and a lagging indicator.
 - Adoption of good project management processes was an option within Chevron for many years. It wasn't until our CEO said we *shall* use the CPDEP process as our project management tool within Chevron that our company rallied around the effort. CPDEP is about selecting the right opportunity and executing that opportunity with excellence.



Joe Gregory is projects coordinator with ChevronTexaco Project Resources Company. He has more than 19 years of experience with project engineering and construction management in the offshore petroleum industry. He holds a B.S. in civil engineering from Texas A&M University. He began his career in New Orleans as a facilities engineer. He transferred overseas in 1987 to work with the company's southern Africa strategic business unit (SBU) on a variety of new field developments. His current position covers the Nigeria-mid Africa SBU, the China SBU, and the Power and Gasification SBU.

Question-and-Answer Session

How should DOE deal with flawed projects brought to the agency by congressional supporters?

Dr. Merrow: It would be very unusual if after project professionals said during that critical scoping phase that it was a bad project, that management wouldn't respond by telling congressional sponsors, "This isn't something we really ought to do." If you raise the issue as project professionals, most of the time you can help kill the bad projects. I don't know any project professional who relishes that role, but in the long run the businesses in the private sector deeply appreciate it, and I would hope that your management would as well.

Mr. Porter: If you see something that you know is not right, then you have got to put that on the table, because if you don't, then resources are going to be spent and value is going to be wasted, and that is money and time and talent that is not going to be available to do what the right thing was to do. The best way I have found [to address this issue] is either through the use of credible experts viewing an issue and commenting on it in a public way, in our case with some of our technologists, or through the use of people who can help you develop the data that then becomes the basis for the decision, and then people can decide anything they want if they have better data. And it helps put it more on a business footing.

What are companies doing to "evergreen" their organizations so that technical competence is maintained?

Mr. Porter: Despite the slow economy, DuPont Engineering is continuing to hire young engineers even though other parts of the company are not. We are trying to operate the company today a little differently from an engineering competency point of view than we operated it in the past. We are trying to run it as an integrated operation and to operate it at corporate critical mass as opposed to critical mass within the centralized competency, so that we can reach out and those people who have those competencies within the business units become a part of that project management group. One of the ways we are going to try to accelerate that training process is by running a project inside. Basically we are doing a DuPont lead project and starting to bring some of our better younger people into that project. It is about a \$30 million job, and we set it up as a center and do a little training on the job.

We have created the DuPont Engineering University, which has brought together the sum and substance of all of what we know about what makes for best practice. We have also created a Project Leaders Academy and a Project Managers Academy, and we are starting to train people in a very focused and aggressive way.

How do agencies with dispersed implementing centers maintain consistent performance, planning, or implementation of projects?

Dr. Merrow: If top management doesn't buy into what is required for a good project system, you will ultimately fail. However, I have seen a number of cases where there is a slow, steady, very effective educational effort by the senior management saying: *This is good for our business.* Let me show you how, give us an opportunity by supporting this and we will show you how it works.

Mr. Gregory: ChevronTexaco has a decentralized organization with business units all around the world working projects in their operational area. Each has its own delegation of authority, each is accountable for the business plan, for meeting the business plan, for setting up the business plan, and making sure that plan is in concert and alignment with the organization.

To what extent have integrated project teams been used during the front-end loading to assess risks, and the results used in crafting the project acquisition strategy, decision making, and execution management?

Mr. Porter: At DuPont, the integrated team is supposed to include all the competencies required to make up a whole project. Once the team has generated enough information to begin to understand the business outcome, DuPont will run a process called decision risk analyst. We refer to that as the DRA, and it is just another one of those discipline tools that you can use to go through and look at the various sensitivities that you have versus price, volume, capital, or what-

ever you are looking to assess. Its output is rolled up into a package that goes to the business managers who make the decision whether to pursue the project.

Dr. Merrow: It turns out that the critical risks for a project in the private sector are around whether or not anybody wants to buy what it is that we are going to make, and those are so fundamental that it is remarkable that we miss them so often. Like most other activities, there are ways to significantly mitigate the risk by doing the right things very early on.

How could private-sector project systems be applied to the federal government, which is not disciplined by market considerations?

Mr. Gregory: Project systems such as CPDEP or PACE can be used for any project, whether it is a road construction project, a disposal site, or a marine vessel. Any project, whether it is capital or not, can benefit and will benefit from a process such as the ones you saw today or we discussed today. The CPDEP process was used to implement the merger of Chevron and Texaco.

Dr. Merrow: Federal regulations make it difficult for project managers to develop the trust relationship needed to efficiently manage a project.

Mr. Porter: Appropriations rules require project managers to come back to Congress for action if their projects overshoot estimates by even a small amount. In this environment, people have a tendency to want to put in contingencies. Now, you have opened the door to other kinds of thought processes about how money gets managed. An owner tends to estimate a project on the basis of what it should cost, not what it will cost, and therein lies a difference in terms of the way you can think about the two types of project system, at least in terms of what I have seen in the past. The key is to come up with some lowest investment strategy, so that you are always only estimating what it really should cost to do that piece of work. If you've got a system that allows you to want to know how much it actually will cost, then you've probably got something that is awry in there. So appropriations rules can make a big difference.

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Wrap-Up Observations

*Robert G. Card, Undersecretary
U.S. Department of Energy*

A major challenge DOE faces is thinking through how the constituency is going to feel about major projects through their entire life cycle. Is the support still going to be there when we start spending money? Too often it really isn't, and so we have to fall back again. The vitrification plant is an example of a project that is in its third or fourth generation right now, because each time talk was cheap and building was expensive.

Many times in the planning stages, a project's constituents will bond together and select a technology, even though there may be far cheaper technologies that are more difficult to talk about and plan but that are in fact the only way to implement the project. Any time we have a project that is in the tens of billions of dollars range, the public is going to ask about opportunity costs for that money. They are going to ask: What can I do for AIDS, cancer, or a whole bunch of other things with that kind of money? Therefore the project isn't stable when you go ahead with it, as those trade-offs begin to be made. Unfortunately, they don't usually get made until we start spending the money, well after we have committed to the project. I think one of the things that as government project managers we need to worry about is what is really implementable. I have a whole list of horror stories within the Department of Energy, particularly with nuclear installations, of trying to merge complexity with nuclear, and it doesn't work very well.

When you have to take a project like a chemical plant through a complex start-up operation, you don't want too much junk in your way, so complex instrumentation control systems, complex safety systems may not in the net add safety value. If they are too complex, the operator can't deal with them. I think DOE needs to be more vigilant about making sure that it is really building only what is absolutely necessary to achieve the business strategy that we should have thought out at the start.