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Asbjørn Rolstadås
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Risk Navigation Strategies for Major Capital Projects

Beyond the Myth of Predictability

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Preface

This book is intended to provide executives with a new way of thinking about capital projects. But to succeed, a new approach must be practical—reflecting the realities of the engineering and construction industry and a deep understanding of what will work and what will not. It must also be current—reflecting current and anticipated conditions as well as the latest industry research. It must be understandable—reflecting the insights of those who work at all organizational levels to transfer knowledge and implement change. And it must be realistic—reflecting the full scope of risks and uncertainties surrounding major capital projects worldwide.

With this book, four experienced authors provide their insights on the need for a fresh look at planning, controlling, and leading major projects in an international setting. We do not critique the project management profession or the current state of art in project management tools; we simply address the fact that, no matter how well we manage projects and how mature our project management organization may be, cost and schedule overruns still occur. The authors explore the reasons for this and provide a framework for influencing the current project management culture in order to improve project performance and outcomes.

The book is structured in three parts with an introduction and some closing remarks. The introduction precedes the first part. It sets the scene and gives an executive overview of the entire book. In Part I the hidden risks in the CAPEX portfolio are explored and a framework for improved performance is introduced. Part II discusses project risk navigation strategies and provides details of an improved methodology. Part III shows selected project risk navigation tactics for a reshaped governance system. In the closing remarks the authors reflect on how the pieces can be put together to create success.

The book is based on results from pacesetting projects, research results of the authors, and experience from developing and implementing industrial solutions through work in industry, consulting services to major international owner/operators, as well as industry studies.

The book is intended for executives who invest in or lead major projects as well as major stakeholders at the executive level. At the same time it is intended for

executive academic programs as it presents fresh results from the research of the authors.

The authors wish to extend thanks to Jim Lozon from the University of Calgary for his valuable comments to the manuscript and for assistance with technical editing and proof reading. The authors acknowledge Steve Revay, Vice President of Revay and Associates Ltd. for his review and comments on the manuscript. The authors also appreciate the support received for travel grants from the Norwegian University of Science and Technology.

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Houston — Richard E. Westney

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Part III Risk Navigation Tactics for a Reshaped Governance System

Abbreviations

AG	Acceptance Gate
CAPEX	Capital Expenditure
CEO	Chief Executive Officer
DG	Decision Gate
EC	Engineering Contractor
EPC	Engineering, Procurement, Construction
ERI	Epistemic Reliability Index
FC	Fabrication Contractor
FEED	Front End Engineering Design
FEL	Front End Loading
HSSE	Health, Safety, Security, Environment
IC	Installation Contractor
ICT	Information and Communication Technology
IFC	Issued for Construction
M&E	Merger and Acquisition
MS	Miscellaneous Services
OPEX	Operating Expenditure
PEO	Project Executive Officer
PL	Project Leader
PM	Project Manager
PMI	Project Management Institute
PR	Public Relations
WBS	Work Breakdown Structure

Chapter 1
Introduction

1.1 Capital Project Predictability

The 2008–2009 global financial crisis raised many concerns about current decision-making practices. It became clear that executives in every industry and across the globe were, perhaps unknowingly, making critical decisions without a complete understanding of the risks involved; and of course this is also true for decisions to invest in major capital projects.

Today, any organization with a significant CAPEX (capital expenditure) portfolio is likely to also have significant risks to its future free cash-flow as a result of potential cost overruns on its capital projects and delays to first production. These levels of risk, and the associated uncertainties surrounding the CAPEX investment decision, have become a significant executive concern. For example, imagine how the executives of Petro-Canada must have felt when the cost trends for their Fort Hills project became apparent [1]:

> Petro-Canada said yesterday its (Fort Hills) oil sands project will undergo startling budget revision as costs have soared from $14.1 billion to $23.8 billion in slightly more than a year… "I agree it is almost unfathomable," William Roach, UTS' (a partner in the project) chief executive said. Shares of all three partners were hit yesterday… The global credit crunch means even Canada's oil sands projects will face difficulties accessing capital.

To put this cost overrun and its impact in perspective, consider that Petro-Canada's share of the overrun, $5.8 billion, on this single project considerably exceeded its $3.8 billion operating cash flow for the previous year.

We do not mean to single out one company or industry. Far from being unusual, this experience is actually quite typical.

Public works and infrastructure have long provided a rich set of case studies in the tendency of overly optimistic early estimates of cost and time to quickly be transformed into harsh reality. Consider the 2012 London Olympics. In their 2003

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bid to host the Olympics, London's cost estimate for the required facilities was £4 billion. Already a large sum, it was revised in 2007 to £9.3 billion, and even that will not cover everything; at least another £5 billion will be needed for associated transport projects that are essential to the Games' success [2].

Whether it is Shell's Sakhalin II project (sanctioned at $10 billion, actual cost in excess of $28 billion), or Boston's Big Dig (original estimate $2.6 billon, actual cost $14.6 billion) the lack of predictability of most major projects has become painfully apparent.

The problem of capital project predictability is serious—and it is time for a serious look at what to do about it. This book focuses on the challenge of developing capital assets by planning and developing large engineering and construction projects. We suggest that conventional approaches to project management and project risk management are no longer sufficient, and a complete rethinking of how we assess project risk, make decisions, and manage projects is required.

1.2 The Dilemma of CAPEX Predictability

Of course, every decision-maker yearns for predictability. To predict is "*to make known in advance*" [3]. Decision-makers in major capital projects have long held a strong expectation that the developers and engineers proposing projects will be able "to make known in advance" the cost and time to complete the project with sufficient accuracy for a responsible investment decision.

Interestingly, a synonym for predictability ("the quality of being predictable") is banality (to be "drearily commonplace"). Surely these decision-making executives would not complain if predictable cost and schedule outcomes were "drearily commonplace." But, as we have seen, predictable project outcomes are far from commonplace—in fact the reverse is true.

In most organizations, management continues to expect predictable project outcomes. Naturally, when projects fail to perform predictably, steps are taken to improve the performance of project teams in hopes of solving the problem. *But what does one do if the level of risks associated with the project's size, duration, technology, location, and prevailing economic conditions make the required predictability impossible to achieve?*

The CAPEX Predictability Dilemma falls to those decision-makers responsible for the decision to fund (i.e. sanction) a capital project. They may be a corporate executive, a member of the Board of Directors or the Audit Committee, the Chief Financial Officer, or the head of a business unit. These participants in the investment decision process are conflicted by a dilemma with these two horns:

- On the one hand, CAPEX decision-makers require (inter alia) a certain level of confidence in the prediction of how much the proposed production asset will cost as well as how long it will take to achieve the expected revenue stream.

- On the other hand, CAPEX decision-makers must acknowledge the hard truth that, when all risks to a project's outcome are considered, this desired level of confidence may simply be unattainable.

Yet a decision must still be made.

We suggest that it is best not to view the unpredictability of major capital projects as a problem to which there is no solution. Instead we believe solutions are found when we think of it as *a dilemma that must be continuously managed*.

This book is about how to manage the CAPEX Predictability Dilemma; that is, how to navigate between the need to be confident and the need to manage risk. And, as we will see, this risk navigation responsibility starts at the executive level.

1.3 Haven't Risk-Management Best Practices Improved CAPEX Predictability?

The industry has not been standing still. Knowing the impact of project performance on financial results, owners, contractors and suppliers have made huge investments over the years to improve the ways they estimate and control the cost and schedule of major projects. Much has been done to institutionalize best practices; perhaps the most important improvements have resulted from the implementation of phased decision processes that stress the importance of evaluating alternatives and investing the time and effort for extensive project definition prior to the final investment decision. Significant improvements have also been made in the information systems used to estimate and control cost and time, and a variety of education and training programs have improved the knowledge and skills of project managers and teams across the globe. Best practices have been defined, expanded and continuously improved, and lessons learned have been documented and shared.

Have all these efforts improved predictability? Of course they have. There is no doubt that considerable improvements in the performance and professionalism of project managers and teams have been achieved. But it is also painfully apparent that the continuous improvement of the conventional approach has not been sufficient. Even projects that positively reek of best practices often end up joining the ranks of "train wrecks".

So, in spite of all this effort, the level of executive concern and frustration about the unpredictability of project outcomes is at an all-time high. For example, a survey of the oil and gas industry [4] revealed that:

> More than half of the executives said they are dissatisfied with their company's overall project performance … (and) believe that many traditional ways of doing business are anachronistic.

This survey went on to say:

> Even major corporations cannot afford to miscalculate the risks. And yet, they do not seem to have a good grasp of how to manage the risks associated with capital projects.

So what is missing? What is needed that we have *not* done so far? Let's start by considering whose problem this really is.

1.4 The CAPEX Predictability Dilemma Cannot Be Delegated Down

The conventional approach to project management and project risk management has been focused on the project level of the organization. Thanks to the enormous efforts made over many years, it is now quite clear what project managers and teams should do, and how they should do it. There is a large population of people who can do these project planning and execution management tasks, and plenty of providers of tools for them to use.

> What is needed now is a change in focus from the project level to the level at which responsibility for strategic decision-making, planning and organization effectiveness truly lies. This is, of course, the executive level.

Effectively managing CAPEX project portfolios requires Risk Navigation: charting the right course between the horns of the CAPEX Predictability Dilemma while preserving the flexibility and adaptability needed to deal with the constantly changing risk environment faced by most major projects today. And this is an executive-level responsibility.

1.5 Risk Navigation Requires Fresh Thinking

The entire body of knowledge of project management and project risk management is based on fixing and achieving project objectives. But it is worth noting Peter Drucker's thoughts on this [5]:

> Management by Objectives works—if you know the objectives. Ninety percent of the time, you do not.

If the pursuit of predictable project objectives is, in fact, destined to be an exercise in futility, we need to think about project management and project risk management in a whole new way. We will show that the picture of project risk has to be extended to include strategic and contextual risks. We define a "territory" of risks that we call *The Bermuda Project Risk Triangle*, and we develop a framework for how to (risk) navigate in this territory. *The Extended Project Risk Navigator* represents a new way of thinking meeting the challenges explained above. It requires us to completely rethink and in many cases *reverse* well-

accepted mindsets and management models. Based on an improved understanding of capital project risk, the implementation of risk navigation may require new concepts for:

- Governance system (adapt)
- Decision process (explore)
- Strategic planning (deliver)

These new concepts are the main components of the new framework we propose for managing project risk (The Extended Project Risk Navigator).

This new way of thinking is the subject of this book. It encourages us to let go of:

- The old perception that uncertainty is "evil" and, instead, become comfortable with uncertainty as a source of opportunity to improve business results.
- Organization strategies based on minimizing headcount and, instead, become comfortable with organization designs based on risk-driven competencies.
- Decision-making based on single-point/deterministic values of project cost and time, and, instead, become comfortable with decisions based on uncertain estimates.
- Planning based on the perceived need to transfer or avoid risks and, instead, become comfortable with plans that accept and manage the risks that are rightfully ours.
- Execution management based on fixed objectives and, instead, become comfortable with an adaptive, flexible management style recognizing that objectives may need to change as the multi-year life cycle of a major capital project unfolds.

Risk Navigation is an open, adaptive way of thinking that allows us to better understand, embrace and even exploit project risk so the CAPEX Predictability Dilemma can be continuously and successfully managed.

1.6 About the Authors

This book introduces a new way of thinking for managing project risk in capital projects. It is practical, current, understandable and realistic.

The authors have been colleagues and collaborators for many years. By combining project management and project risk management experience from owner, contractor, and consulting organizations, with an academic research perspective and a broad international point of view, we have provided a solid approach for executives to meet the challenge of CAPEX unpredictability.

Per Willy Hetland recently retired from Statoil and is currently an Adjunct Professor and Program Chair in Project Commercial Management at the Norwegian School of Management BI and The University College of Haugesund, Norway. He also served as an Adjunct Professor at the University of Stavanger,

Institute of Industrial Engineering for 16 years. Dr. Hetland's 30 year career with Statoil involved project and management positions including Project Director, Finance and Procurement, and Director of Professional Development assigned to the European Institute for Advanced Project and Contract Management, EPCI; where he chaired the faculty for the European Program for Project Executives (an Executive Masters program delivered by a joint venture of seven European universities). Most recently, he was Director of Competence Development and Integration for the Statoil Project Academy in cooperation with the University of California at Berkeley.

Dr. Hetland is the author of 10 books and over 20 articles and papers. He was the first president of the Norwegian Association of Project Managers, and he has also served on the boards of the Norwegian Association of Cost and Planning Engineering, the Nordic Project Management Association, the International Project Management Association, and the International Cost Engineering Council. He holds degrees in Civil Engineering, Business Administration and Social Sciences. His PhD, from Aalborg University in Denmark, addresses Goal Directed Strategies for Complex Capital Projects.

George Farage Jergeas is Professor of Project Management at the University of Calgary where he also was the Director of the Project Management Program. His current research interests are focused on construction productivity, team dynamics, and the drivers of cost overruns on mega-projects. Prior to taking this university position in 1994, Dr. Jergeas had extensive experience in the construction industry including construction management and claims dispute resolution.

He is an active consultant and coach in the Canadian construction industry, focusing on project risk management and team effectiveness. Dr. Jergeas has pioneered methods for building and sustaining high performing project teams, which have been applied on major projects across Canada. He is the author of over 90 articles and papers. He received a Bachelors degree in Civil Engineering from the University of Baghdad, and an M.Sc. and PhD in Construction Management from Loughborough University in the UK.

Asbjørn Rolstadås is Vice Dean for research at the Faculty of Engineering Science and Technology and a Professor of Production and Quality Engineering at the Norwegian University of Science and Technology. He is the author of 12 books and over 260 papers. Dr. Rolstadås has over 30 years of experience in education, research and consulting in project management and project risk management for major international projects.

He is past president of the Norwegian Academy of Technical Sciences and was elected to membership in The Royal Norwegian Society of Sciences as well as the Royal Swedish Academy of Engineering Sciences. Dr. Rolstadås is the founding editor of the International Journal of Production Planning and Control, and is past president of The International Federation for Information Processing and the Norwegian Computer Society. He has also served on the PMI Member Advisory Group for Standards and on the boards of the Norwegian Association of Cost and Planning Engineering and the Norwegian Association of Project Managers He

received Masters and PhD degrees from the Norwegian University of Science and Technology.

Richard E. Westney founded Westney Consulting Group in 1978, a Houston-based consulting firm serving energy industry executives with strategic risk management, and improving the performance of project organizations. Prior to the formation of Westney Consulting Group, he was engaged in managing major international projects for Exxon. The author of five books and numerous articles on project management and project risk management, Mr. Westney served as visiting faculty at Texas A&M and Stanford Universities, as well as the Norwegian University of Science and Technology.

A member of the Executive Board of the Engineering and Construction Contracting Association, he is also a Fellow and Past President of The Association for the Advancement of Cost Engineering, and received that association's highest honor, The Award of Merit. A licensed professional engineer, he is a graduate of the City College of New York, Rensselaer Polytechnic Institute, and Harvard Business School.

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Part I
Exploring the Hidden Risks in the CAPEX Portfolio

In Part I we argue that there are types of project risks not sufficiently understood and managed. We see a situation where much attention is given to definition and performance risks and too little to organization and background risks. We call this the myth of predictability. If we can predict the future accurately enough, there is less risk exposure. Yet we still see cost overruns. We need consequently to look for additional new solutions.

It is about time to rethink how we manage project risk in projects. Traditionally, uncertainties and risks have been perceived as unwanted or even "evil" by nature. Hence they should be reduced, and if possible, eliminated. Conventional project risk-management approaches aim to "isolate" the project domain from interference by corporate management on the one hand and relevant project external environments on the other hand.

The challenge of interference from relevant project external environments is dealt with by establishing buffers and barriers that are intended to withstand the impact caused by unexpected events that might jeopardize project performance. Conventional project risk management may increase the predictability of project outcomes, but it tends to ignore the business value that may be added through the project execution phase.

We present a sketch of a new approach to project risk management or project risk navigation. In Part II we will explain the new approach in detail.

This Part I covers:

Exposing the Myth of Predictability

Rethinking Project Risk Management

A New Approach to Project Risk Navigation

Chapter 2
Exposing the Myth of Predictability

2.1 Cost Overruns

Predictability for major projects never seems to meet expectations. This has been a significant executive-level concern long before the rapid escalation in costs from 2005–2008. Today, that concern is more acute. In many companies CAPEX is severely constrained and managers must deal with tough questions as to which projects to defer, cancel, initiate or renegotiate. With fewer projects going forward, failure is clearly no longer an acceptable option.

Most energy industry owners and contractors have not been able to reliably predict the cost and duration of their large, complex capital projects. According to a recent survey [2], the majority of energy industry executives:

- Are dissatisfied with project performance (40% of capital projects overrun), and this level of dissatisfaction is the highest ever.
- Agree that poor project performance is not acceptable when the market expects predictability.
- Accept that they cannot afford to miscalculate project risks, yet admit they do not have a good grasp as to how to manage them.

There is good reason for these concerns. Whether it is a huge oil and gas development such as Shell's Sakhalin II, the oil–sands developments in Canada, infrastructure improvements such as Boston's Big Dig, deepwater production such as BP's Thunder Horse, gas production such as Statoil's Snøhvit LNG, or nuclear power generation such as Finland's Olkiluoto 3 reactor, the experience of major cost overruns and lack of predictability has been much the same. Surprisingly, these cost and schedule overruns often continued to grow as the project progressed, even right through to completion. This trend was clear long before the rapid escalation in project costs began 2005 and is an even greater concern in today's economic conditions.

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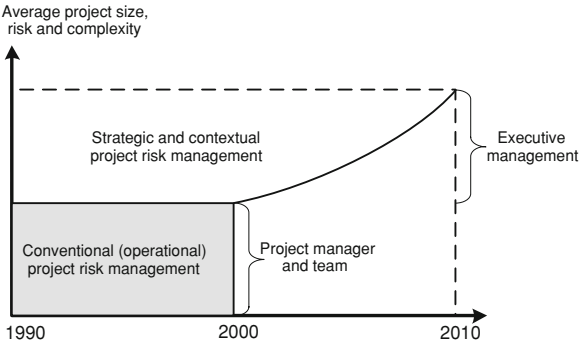

Fig. 2.1 Beyond conventional project risk management

Even though project management is becoming a mature profession and the current body of knowledge is commonly applied in the industry, delays and cost overruns have been occurring for a long time.

An in-depth study [3] analyzed the performance of 246 infrastructure capital projects in 20 nations and 5 continents spanning most of the 20th century. This large sample of projects provided statistically significantly conclusions that the actual cost of rail projects averaged 45% higher than estimated, tunnels and bridges 34%, and even roads overran by an average of 20%. Moreover, the data demonstrated that this tendency to cost overruns had not improved with time.

This same tendency can be observed for other type of projects. For example, the final cost of the Sydney Opera house was almost 14 times the original budget and it was completed 10 years late while the Denver Airport was opened 16 months behind schedule at a cost almost three times the original budget. Similarly, industries such as offshore oil and gas have seen similar results when very large projects are undertaken.

In general, these projects were designed and built by world-class engineering and construction firms. These are organizations with decades of experience, hundreds of skilled people, deep technical knowledge, state-of-the-art equipment, and well-documented project management best practices. Is there something about very large projects that renders the conventional approach inadequate? Could it be that organizations that are so experienced are also set in a conventional way of planning and executing projects? Is there a better way to think about the causes of these overruns, and a better way to manage them so there are no surprises when the project is completed?

2.2 Risk Exposure and Volatility

Let us begin by considering how the size and complexity of major capital projects calls for extending conventional practice to address these added challenges. Figure 2.1 illustrates the gap in the understanding of risk that we will highlight.

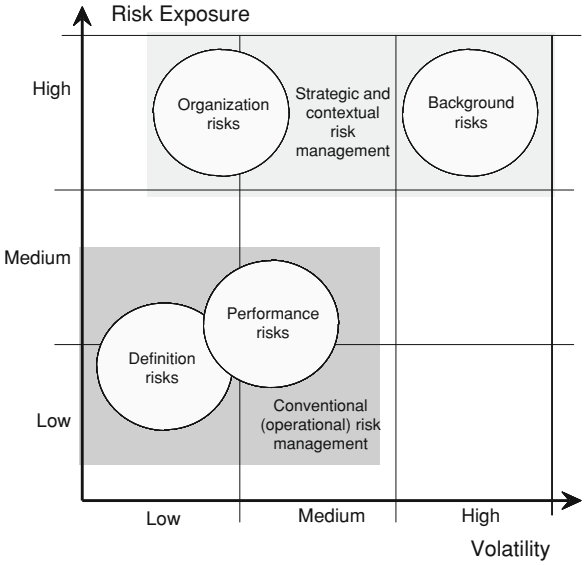

Fig. 2.2 Risk map showing risk exposure and volatility

It illustrates how conventional project risk management, focused on the operational risks manageable by project teams, was appropriate for a conventional project up to the year 2000 or so. But, as projects became larger and more complex, other categories of risks started to dominate and became critical.

These strategic and contextual risks are typically outside the responsibility of the project team (who has neither the capability nor authority to manage them). Therefore they are usually not included in contingency. Strategic and contextual risks are often considered outliers and either ignored or "assumed away".

These uncertainties expressed in terms of volatility, however, have a significant potential impact on the project's outcome, which we express as *risk exposure*. Since these risks do not necessarily reduce with time, they have and retain significant uncertainty which we express as *volatility*. The relationship between risk exposure and volatility provides a new way of looking at project risk which is illustrated in Fig. 2.2.

Here we can see why cost overruns can occur. Most organizations focus their attention on definition and performance risks and give too little attention to organization and background risks, thereby increasing their risk exposure and volatility.

The project management profession has matured over the last decades. Good practice is well documented and known, for example, *A guide to the project management body of knowledge* (PMI) [4] and other standards. These standards represent structured approaches to managing most projects. There are other approaches that focus on organizational development and how the organization can be influenced to best achieve project objectives. Andersen [1] discusses different approaches and distinguishes between a *task perspective* and an

organizational perspective. We will argue that they are both necessary, but not sufficient to manage the CAPEX Predictability Dilemma described in Chap. 1.

This book suggests a fresh approach which requires re-thinking the three elements that provide the foundation for how an organization manages projects:

- The governance system.
- The decision process.
- The strategic planning.

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Chapter 3
Rethinking Project Risk Management

3.1 Current Risk Management Thinking

Project management is now a mature profession. The current body of knowledge is extensive and commonly applied, using concepts based on business experience and best practice as well as research. Much attention has been given to predicting final cost and project duration. There are good tools available to facilitate cost estimation, project scheduling, and managing project risk. Yet projects still fail to meet expected outcomes. So the question becomes: "*How can we improve?"*

Current best project management practice, as experienced, collected and utilized in industry by consultants and practicing project managers, has become accepted and recognized as core knowledge which most professionals seem to agree is valid for use on most projects most of the time. Mega projects, especially in the defense, oil and gas, and construction industries have provided valuable input for establishing this *common knowledge* which has become the basis for standards such as *A Guide to the project management body of knowledge* [18]. Similar standards are found in the UK, Japan, Australia and other regions. A project manager, following the guidelines contained in these standards, takes advantage of this accumulated knowledge and, in theory, should be in a position to control his or her project well. Yet these standards, guidelines and *common knowledge* still do not guarantee that the project will finish on time, within budget and with project objectives being delivered as foreseen in the business plan.

Projects that significantly overrun their budget or experience a severe delay often attract the attention of the mass media, particularly for large public or governmental capital projects. Naturally this has led to a strong focus on risk. No project manager is comfortable with the press releases showing bad performance for his or her project, so every measure is taken to mitigate risk.

The current best practice to manage major capital projects focuses on these major topics:

A. Rolstadås et al., *Risk Navigation Strategies for Major Capital Projects*,
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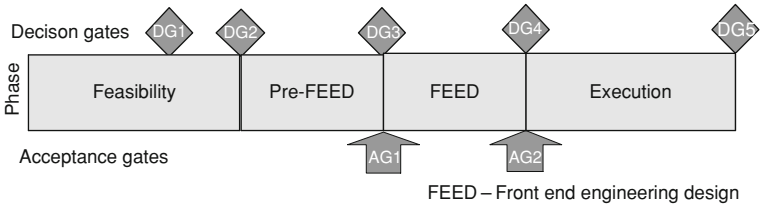

Fig. 3.1 Phase-gate approach

- Phase-gated development process.
- Governing documentation.
- Team alignment.
- Risk management.
- Stakeholder management.
- Contract structure.

Large organizations undertaking major capital projects all have their own best practices described in a set of documents. These documents contain guidelines and requirements describing how the company should practice good and sound project management. They are referred to as *governing documentation*. Every project team member is expected to know these documents and practice in accordance with them. As time goes by and experience is created, such governing documentation can become quite comprehensive and, in the end, almost impossible for any project manager to comply with in full.

The phase-gate approach splits the project into a number of phases along a timeline. Control points are set in the form of *decision gates* (*DG*). To pass a decision gate and proceed into the next phase requires the signature of a "gate-keeper", a person or committee empowered to make the next funding decision. This gate-keeper checks that all conditions are met before proceeding, and that no project is allowed to proceed if work or specifications are incomplete. Fig. 3.1 illustrates a phase-gate approach.

At each gate a major decision is taken:

- Continue with the next phase of the project.
- Cancel the project.
- Rework and seek new approval later.

A decision to proceed is normally dependent on a certain level of maturity in the project work to date. The idea behind this is that there are certain conditions for being allowed to enter through a gate. These conditions are defined in governing documentation. A particular condition could be a checklist of documents to be completed to a defined quality level, or it could be a defined level of uncertainty for a cost estimate.

Figure 3.1 also shows a set of *acceptance gates* (*AG*). An acceptance gate represents a stage in the project where an approval or acceptance needs to be obtained, for example, a regulatory approval or an acceptance from a joint venture

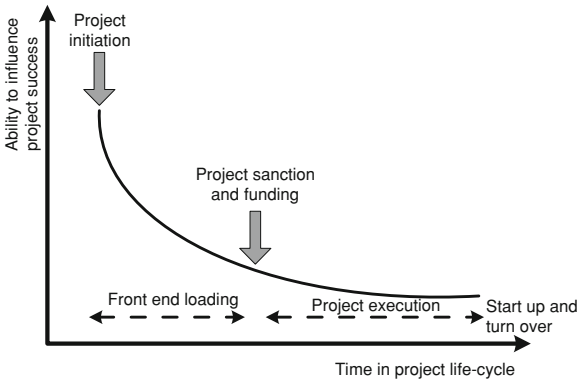

Fig. 3.2 The project influence curve

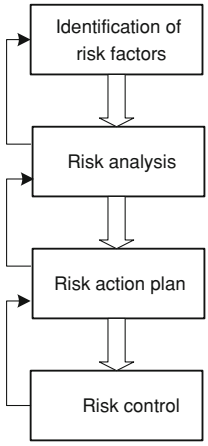

Fig. 3.3 A common risk management approach

partner. The AG are also important for deciding whether to pass through a decision gate.

The conventional thinking about project risk has led to much attention on the concept of front-end loading (FEL). The main philosophy behind the FEL concept is to reduce the probability of cost and schedule deviations by fully defining the project before execution begins. In this way the risk is reduced and the probability of on time and on budget performance is increased.

The principles of FEL and the various phase-gate processes (see Fig. 3.1) that provide the framework for implementing them are generally well-accepted and certainly broadly applied on major projects. Considerable effort has been spent improving the understanding and inventory of best practices. Chief among these has been an increased emphasis on the critical early stages of a project (the "front end"), when plans and decisions have by far the most influence. The project influence curve (see Fig. 3.2) has been the driver of much of this conventional wisdom.

Much focus is paid to selecting the appropriate team, and many companies have developed quite advanced knowledge management systems to track the

competence they need. Training programs are used to develop project management competence. The power of well performing teams seems to be precisely understood and accepted.

Risk management has become mandatory for all major capital projects. Most projects develop a risk register in the early phases. Figure 3.3 shows a common approach for managing risk. It contains four steps:

- *Identification of risk factors*—defining what events or conditions might represent a threat to the project.
- *Risk analysis*—estimating the consequences of each risk factor.
- *Risk action plan*—developing a plan showing the various options concerning the risk factor and what mitigating actions can be taken.
- *Risk control*—monitoring the actions taken and continuously evaluating whether there are changes in the risk level or whether there are new risk factors to take into account.

Stakeholders may also have a strong influence on a project. A project manager must know the most important stakeholders and what motives they may have. There must be a strategy for how to manage each of the most important stakeholders.

Most major capital projects have a number of contractors who are responsible for various parts of the project. The contract structure as such and the incentive and control mechanisms applied are both important success factors in any project.

3.2 The Tunneling Concept

How could it happen? The team apparently did everything right.
Knowing the project would cost billions, and had great strategic importance for the company, the project team carefully followed a phase-gate process, investing significant effort in each phase and preparing comprehensive decision-support packages at each decision gate. Project reviews, peer assists, and project audits were conducted to ensure compliance. Years later, by the time the project was sanctioned, every aspect of the design had been thoroughly studied and defined.
The executive committee was assured that this level of FEL provided high confidence of success. And so the project was approved, with all stakeholders expecting a final cost within budget, and a revenue stream beginning on or ahead of schedule.
Yet it did not take long for things to turn south. Unforeseen price increases caused early and significant overruns in engineered equipment and bulk materials, with corresponding increases in lead times. Host country legislation changes delayed permits and increased local content requirements, reducing productivity and further increasing cost. As the construction work began, the project found itself competing with unanticipated demands for

skilled labor and supervision, and it was never able to mobilize the full complement of required workforce. Since the engineering and construction contractors had been unwilling to accept project risks, the owner's executives found themselves explaining to analysts and shareholders why the project was costing much more than expected, and revenues would be delayed.

In his book on Black Swans, Taleb [22] explores the reasons why financial disasters often occur due to risks which, with hindsight, seem eminently predictable. He defines Black Swans as risks that are considered to be outliers and thus ignored until they occur with great impact, at which point explanations are quickly concocted to make them seem to have been predictable.

Taleb offers a wide range of explanations as to why well-intentioned, competent professionals seemingly ignore significant risks when making plans or critical decisions. Among these is the *tunneling* concept.

Tunneling is the neglect of sources of uncertainty outside the plan itself. It is evident when data that supports our proposition is embraced and utilized to further increase that support, while data that challenges it is ignored, dismissed, or severely discounted. This tendency is often referred to as "confirmation bias". As our investment of time, effort and money in developing and supporting our proposition increases, we are tunneling deeper. We are likely to become more anchored to our solution and, of course, to be reducing our ability to see outside the boundaries of our assumptions.

An example of how tunneling can influence professionals is as follows:

> Very early (and usually optimistic) expectations of project cost and time to production are established. Although at this early phase there is little information on which to base these numbers, they effectively define a base case which anchors all the work that follows. In many situations, based on this base case, critical commercial commitments are made and expectations for the investment community are created.
>
> As the work progresses, assumptions are made to support the base case. Of course, any deviations from the base case are apt to be met with great resistance if not hostility.
>
> A design configuration that seems to support the base case is prepared. In order to minimize the time to sanction the project and to start production, little time is spent exploring alternatives or testing the hypotheses underlying the base case. The phase-gate process drives considerable effort to develop and define the base case. Recycle is discouraged in order to keep progressing toward sanction.
>
> Eventually, when the time for sanction arrives, the time and effort invested in Front End Loading is considered a primary indicator of the predictability of the cost estimate and the time to first production. If the phase-gate process has been followed diligently, predictability is assumed to be high.

Figure 3.4 illustrates this process. Note that the first formal assessment of risk and uncertainty usually occurs at the end of the feasibility phase. As the work progresses, uncertainty and risk are assumed to decrease, resulting in *tunnel vision*.

Black Swans represent risks outside the assumptions underlying the base case (see Fig. 3.5). Typically, they are not addressed by phase-gate processes. Note that Black Swan risks are typically not correlated with time or progress—in fact, their severity may well increase over time. For example, the geopolitical risks

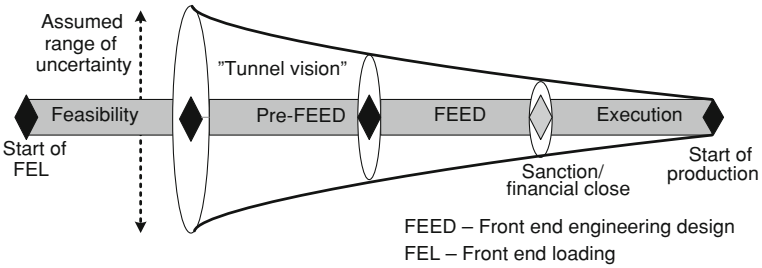

Fig. 3.4 The tunneling concept as experienced on capital projects

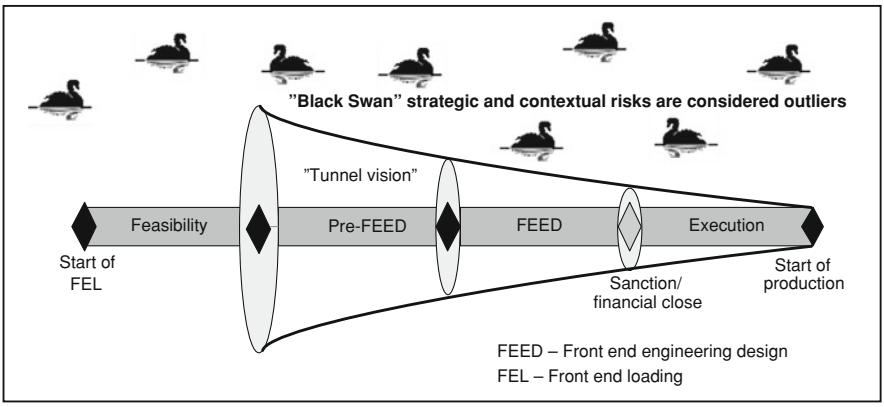

Fig. 3.5 Black Swans and tunnel vision

impacting an international project may increase over the project's life—indeed, a mega-project in some locations may itself be a driver of political risk. Although the diagram is not scaled, we can also note that the magnitude of the uncertainty and potential impact of these risks tends to be far greater than the operational, project-level risks covered by contingency.

3.3 Need to Improve the Practice

Traditionally, uncertainties and risks have been perceived as being something unwanted or even "evil" by nature. Hence they should be reduced, and if possible, eliminated. Conventional project risk management approaches aim to "isolate" the project domain from interference by

- Corporate management.
- Relevant project external environments.

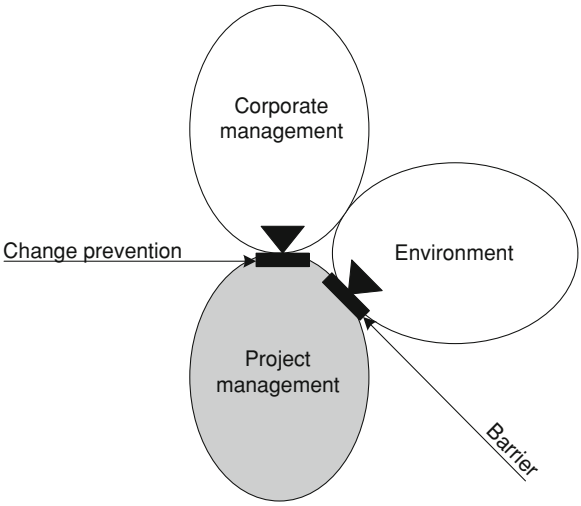

Fig. 3.6 Barriers against influence in the conventional project risk model

The challenge of corporate management interference is dealt with by focusing on a detailed and distinct definition of the project work scope and rigorous change procedures, making it difficult for corporate management to amend work scope after the start of project execution.

The challenge of interference from relevant project external environments is dealt with by establishing buffers and barriers that are intended to withstand the impact caused by unexpected events that might jeopardize project performance.

Conventional project risk management may increase the predictability of project outcomes, but it tends to ignore the business value that may be added through the project execution phase. *The focus is on what may go wrong and not on how emerging opportunities may be encouraged and additional profit harvested.*

Figure 3.6 illustrates how conventional project risk management creates barriers against influence from corporate management and relevant project external environments.

An important implication of the conventional project risk management model is that it encourages reuse and standardization of project procedures leading to improved project execution efficiency. Another implication of the conventional approach is that the less the project at hand differs from past projects, the higher the predictability of project outcomes. The notion of project best practice then deteriorates in the sense that new projects are encouraged to be designed and executed in a manner that is as close as possible to past projects. Repetition is the focus and projects are perceived as repetitive tasks rather one-of-a-kind unique endeavors.

The conventional project risk model is particularly useful in its focus on internal matters which enhance project execution efficiency. Further, it encourages protective mindsets and helps managers understand how defensive project strategies may be designed. In a sense projects are perceived as being executed

on an isolated island, well protected from interference by corporate management and the surrounding environment. However, if results are to be improved, there is a need for a new concept that is able to extend the conventional model so it may be applied to handle risk issues faced by projects today that frequently have to be executed with a close and dynamic interaction between project and corporate management in order to deal with often turbulent external environments.

The implementation of phase-gate processes over the past 15 years has provided considerable improvement in project performance. Well-defined and carefully thought-out projects clearly have a better chance of success than do those that are ill-conceived and sanctioned in haste. Decisions that are based on good information are certainly better than those that are based on optimistic assumptions.

However, the overall predictability of capital project portfolios is still a significant issue as many major projects experience significant cost overruns and schedule delays even though a phase-gate process has been diligently followed.

Clearly, there are other forces at work. *Is it possible that our focus on rigid adherence to process can blind us to important perspectives that need to be considered if projects are to succeed?*

The phase-gate processes encourage tunneling and care must be taken to ensure that their implementation does not result in sanctioning a project that is, in fact, based on false premises.

The Black Swan thinking discussed in the preceding section demonstrates that there is a risk picture that is normally overlooked. *Are there other types of project risks that are overlooked as well*? Before we try to answer this question, we need to take a closer look at decision making and the terms uncertainty and risk.

3.4 Exploring Decisions Influencing Risk

Management is about making decisions, and decisions introduce risk. Actually, decision making is a discipline in itself using probability theory and mathematical statistics to solve problems that have uncertainty. Operations research uses models to describe the decision making process and provides theory for making the optimal decision. This book is not about such an approach to decision making. However, we need to understand the nature of decisions and the process of making and implementing decisions. For this purpose we will borrow a model from decision theory.

Figure 3.7 shows a situation where a *decision maker* decides an *action*, x, amongst a set of feasible alternatives. Independent of the decision maker, Nature decides (i.e., beyond the control of the decision maker) a *state*, t, amongst a set of potential states. The decision maker's choice of an action and Nature's choice of a state gives a *result* or a *consequence*, y, from a set of potential results. It includes only the results or consequences of interest to the decision maker. In addition,

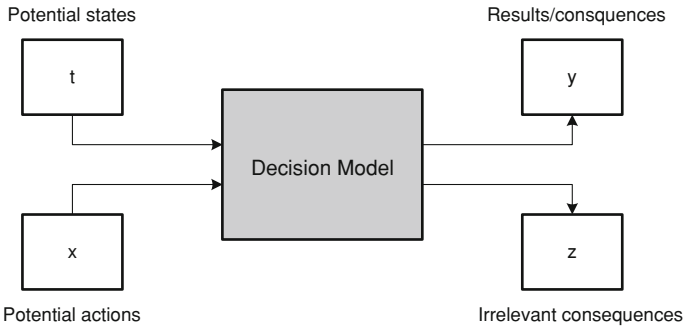

Fig. 3.7 *Decision model*

the action x may have some *irrelevant consequences*, z, of no interest to the decision maker.

The potential states represent non-controllable factors. They introduce uncertainty to the decision. We can control our own action (x), but there is always something else interfering that we cannot control (t). In addition to the results that we are interested in (y), there are some other consequences that we do not consider important (z). However, others may find these consequences unacceptable. Thus decisions may be controversial.

The phase-gate approach (explained in Fig. 3.1) can be applied at different levels. At the top level of a company, it will represent project portfolio management. The outcome of that is a portfolio of projects to be launched or considered. Each project has also a number of decision gates. The project may be broken down to a number of contracts which again might include decision gates. The procedure is illustrated in Fig. 3.8. It looks similar to a work breakdown structure, and can be more detailed, including additional levels for large and complex projects.

The type of decisions may vary dependent on the level. At the portfolio level, the decisions may typically be:

- Go/no go for a project idea.
- Frame conditions for the project.
- Resource need and availability.
- Timing.

At the project level, the decisions may typically be:

- Business objectives.
- Technical solution.
- Contract strategy.
- Project team.
- Selection of suppliers or contractors.
- Contingencies.

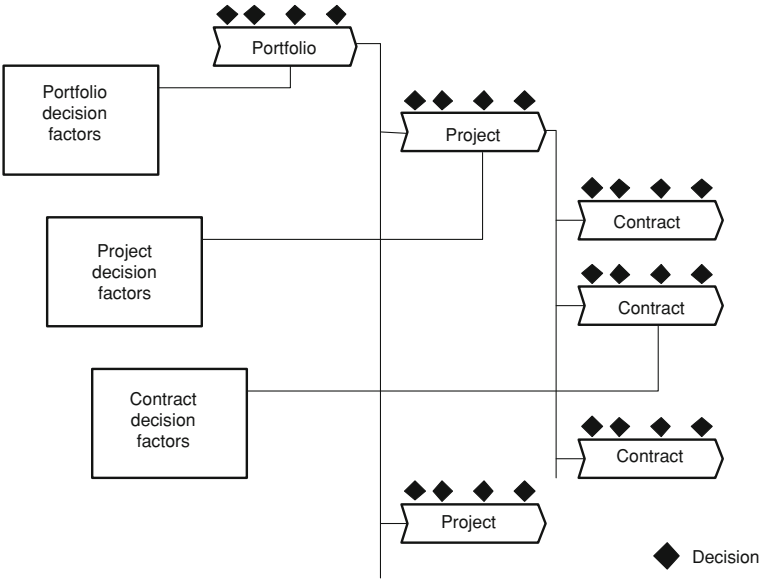

Fig. 3.8 Decision levels and decision factors

At the contract level, the decisions may typically be:

- Scope changes and variations.
- Approval of deliverables.
- Client/contractor interface.

For all types of decisions, there are a number of *decision factors*. Decision factors are rules for how to make a decision. They may say that certain aspects should be considered, for example, the environmental impact of the project, social responsibility, quality, schedule impact, price, etc. (see Fig. 3.8).

Figure 3.9 shows the *decision process*. A decision is prepared based on a number of inputs such as results from preceding work, any problems identified and objectives or policies for the project. The decision is prepared using the decision factors and any available methods. The result of the decision is a go/no go. In the case where it is a go decision, a number of actions are identified to implement the decision. These actions produce some results that have to be approved. At the end there is the final approval which might be in the form of a decision gate.

3.5 The Nature of Uncertainty

The difference between uncertainty and risk is not always acknowledged; the terms are often used as synonyms. We look at uncertainty as a measure of a range of likely values while risk is a potential event that has both a probability and an

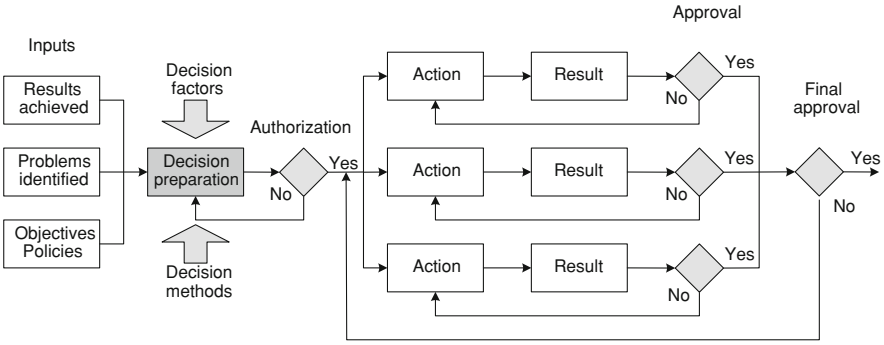

Fig. 3.9 Typical decision process

impact. We shall now explore the concept of risk further before we discuss how the climate for risk driven decisions can be improved.

While risk is a term that has been dealt with for a long time [1], uncertainty is a relatively modern term. In the 1920s a distinction was made between risk and uncertainty [14, 20]. This distinction is important as it highlights risk as a *known* and uncertainty as an *unknown*. The term *known* means that, in the case of risk, the outcome of an event can be calculated. Risk was originally closely related to games, mostly involving money [1].

The term *risk* is derived from the Latin word *risicare*, which means *to dare*, hence the term risk implies a choice rather than a fate [20]. Consequently, the fundamental issues concerning risk can be addressed by the question: *shall we risk it or not*? A number of definitions of the term risk have been proposed over the years, of which probably the most cited in the domain of project management today still is: *consequence x has a probability of occurrence* [12]. This outcome and its impact may be positive or negative. The positive outcome we call opportunity, the negative outcome we call risk. If we focus on the negative, this definition, in essence, implies that risk is a weighted consequence of something being feared or unwanted if it materializes.

We can now define the following terms:

uncertainty, risk factor, opportunity factor, consequence, risk, opportunity

The relationship between the terms is illustrated in Fig. 3.10. The implication of uncertainty may be negative and positive. We refer to the negative implications of uncertainty as *risk factors*. This is what is normally focused on in traditional risk management approaches. The positive implications of uncertainty are often overlooked but may be just as important for the project outcome as the negative. We refer to the positive implications of uncertainty as *opportunity factors.* Both may have a *consequence* if they occur. We refer to the consequence times its likelihood of occurrence as either *risk* (negative) or *opportunity* (positive).

In the project management domain, uncertainty is currently understood as *lack of information* [12]. A slightly different definition is *lack of certainty* [3].

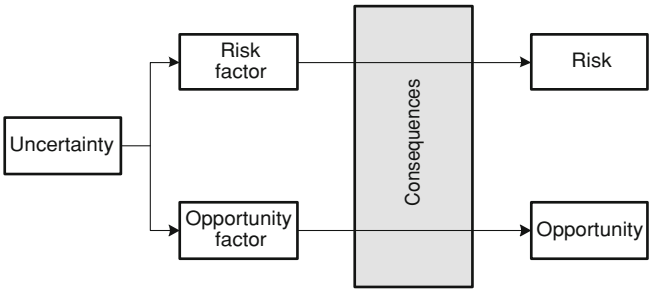

Fig. 3.10 Relationship between uncertainty and risk

In this book we have applied the latter definition that we consider to be a much broader term.

Uncertainties may take on a number of very different forms; hence we see a need for a categorization of uncertainties. A point of departure is to establish a structure that integrates the old distinction between risk (the *known*) and uncertainty (the *unknown*). Such a structure is proposed by Hetland [10]. In the following we apply an adaption of this structure, referred to as the *uncertainty matrix*. This 2×2 matrix combines two different stages of data (*known or unknown*) and two different states of the event from which the uncertainty originates (*closed or open*). In the matrix, four prime categories of uncertainty are identified:

- Known-closed (deterministic uncertainty).
- Known-open (volatility).
- Unknown-closed (lack of information).
- Unknown-open (undetermined uncertainty).

In the known-closed segment of the matrix the *uncertainty is fully predictable*. However, as we are executing a project one time only, we still cannot predict the final outcome with certainty, a dilemma referred to as the flaw of averages.

The other three segments represent *lack of predictability*. In the known-open segment, uncertainties are identifiable and expected. This perception of uncertainty is reflected in tunnel vision. In the unknown-closed segment, the information available to us is incomplete and ambiguous, hence quality decisions cannot be made. Typically, this kind of uncertainty occurs at defined project decision gates. In the unknown-open segment, uncertainty is unidentifiable and unexpected. It is in this segment that we find the black swans.

The *known-closed* (*deterministic uncertainty*) category is similar to the spinning wheel of casinos. We recognize this as a zero sum closed game situation where all information about *possible outcomes are fully known*; i.e. the number of possible outcomes, their values and their probability of occurrence are all known.

The *known-open* (*volatility*) category is recognized as the planners' and schedulers' dilemma. As the result of an event or decision has not yet happened, the planner *guesses* possible outcomes; i.e. the number of possible outcomes, their

values and their probability of occurrence are all based on historical observations and the application of subjective or inter-subjective probabilities. Though the degree of inter-subjective agreement may be high and measured through the application of an epistemic reliability index, ERI [6, 9, 10], the true implication of uncertainty is still a *guess based on professional judgments*.

The *unknown-closed* (*lack of information*) category is recognized as *lack of information*. Uncertainties in this category are rooted in missing pieces of information related to events that have taken place, hence may give a picture that is *incomplete and ambiguous.*

The *unknown-open* (*undetermined uncertainty*) category is often referred to as *unknown–unknown* [3] or *complexity* [5, 7, 9, 10, 15]. The notion of uncertainty in this case highlights that complexity has to do with *unpredictability of future outcomes* and that it cannot purely be reduced to a closed system perspective embracing a large number of interfaces between a large numbers of components. In essence, this is what distinguishes complexity from complicatedness [5, 15]. Any situation or outcome that is *complicated* can be defined or calculated at a high level of precision, a complex situation or outcome cannot.

The *unknown-open* (*undetermined uncertainty*) category embraces uncertainties that are unidentifiable and unknown at the time that particular project decisions of some significance are to be made. Subgroups of this category of uncertainty have been identified as:

- Self-organizing.
- Tipping points.
- Black swans.

Contemporary theories model organizations as *systems.* Such *system*s may be described as: *dynamic* as opposed to static, *agile* as opposed to lean and *open* as opposed to closed. From a system perspective, organization complexity may be defined as *the interrelatedness and interdependence of components and their freedom to interact, align, and organize into related configurations* [5]. In general, this indicates that *the behavior of complex systems cannot be fully predicted*. This means that the more turbulent the project environment and the greater the project organization's freedom to organize and act, the higher the level of unpredictability of project outcomes.

From chaos theory we know that when a deterministic non-linear system is driven away from a peaceful state of stable equilibrium towards a hectic state of explosive instability, the system displays highly complex behavior by oscillating randomly between positive and negative feedback [21]. As complex systems are sensitive to initial conditions, small changes may drive such systems far from equilibrium into chaotic behavior. Chaos theory helps us to understand why deviations to project schedules and budgets may escalate uncontrollably towards a tipping point. It is at this state that the project director is beheaded [11] and the project A team is replaced by a project B team. The more unknown the states and the more open the environment in which they may develop, the higher the level of unpredictability in project outcomes.

Finally, black swans may pop up from nowhere and are often independent of project processes. Black swans may be conceived by man or nature and are highly unpredictable, though often predictable seen in hindsight. Why did we not think of this particular black swan as a possible threat in the first place?

3.6 Implications of Uncertainty

We now introduce a distinction between:

- Something being uncertain, and.
- The implication of something being uncertain.

Something being uncertain relates to the originators of the uncertainties, defined as

- Caused by nature.
- Caused by man.
- Implied by deployed technology.

Further, *the implication of something being uncertain*, relates to

- Urgency of time.
- Potential consequences.
- Risks.

Uncertainty related to *nature* spans a range from extreme forces with low frequency such as major earthquakes to normal forces of high frequency such as bad weather conditions. Weather conditions during project execution are generally not known at the time of planning. However, the closer we get to the time of execution, the better weather forecasts can be provided. If the weather conditions at the start of a weather sensitive activity are unacceptable, the operation could be delayed. If bad weather conditions deteriorate during a sensitive operation, the operation can be suspended for a period of time. In both cases, continuous monitoring of weather conditions provides the contractors with accurate information enabling them to decide to delay or abort a planned operation as appropriate.

Earthquakes are somewhat different. Generally earthquakes cannot be forecast in the same way that we can forecast bad weather. If a major earthquake occurs prior to a sensitive operation, the operation could be delayed or aborted. However, if a major earthquake occurs during an operation, the situation may be dramatically different.

Uncertainty related to *deployed technology* embraces possible malfunctioning of equipment and systems. Such uncertainties may be traced back to errors in design, damages caused by transportation or storage prior to construction, construction errors, inadequate testing or commissioning and breakdowns in operation. In essence, uncertainty in deployed technology can, in some way, be traced back to errors made by man.

Uncertainty related to *man* includes behavior of single individuals as well as decision making within and between organizational units collaborating in the planning and execution of projects. Alternately, man, at any level, may reveal an opportunistic behavior that results in limited intentional rational acts [23].

Uncertainty, or lack of certainty, may reveal good or bad news when known. In this book we focus on the bad news and therefore we view lack of certainty as a threat. Similarly, lack of uncertainty can also reveal opportunities.

In order to deal with uncertainties, we need to know more precisely how we are threatened by lack of certainty. We categorized uncertainties in three prime groups; caused by nature, by deployed technology and by man. For simplicity reasons, each category is linked to the actual (what has happened) or to the potential occurrence (what will or may happen) of an event. Uncertainty relates to:

- *If* an event has been identified.
- If an event *has* or *will occur*.
- *When* an identified event might occur.
- *What damage* the identified event may cause if it occurs.

We refer to the last statement as a *consequence*. Note that the term consequence is considered a *threat* (risk factor) before an event takes place and a *damage* after. The *likelihood* of an event actually taking place is not accounted for in the term consequence.

In a project setting, the term risk is troublesome as the context is somewhat different to playing in a casino, due to the following situational characteristics:

- A project is only done once, hence average outcomes and expected values are irrelevant (referred to as the flaw of averages).
- During the project life cycle, the same threat may change in terms of risk (either the consequence or the probability of occurrence may change).
- The consequence cannot simply be calculated as the immediate effect of an event; often primary consequences lead to secondary consequences (the development of the damage may level off or escalate depending on established barriers and organizational resilience).
- The likelihood of occurrence of a threat is mostly based on professional judgment, rather than being calculated.
- Some threats cannot be foreseen at project start; they may emerge over time or they may occur without any warning.

We are in need of broadening the definition of risk to include the unknowns, having in mind that the primary objective of making decisions under uncertainty is to rank options and make the right choice. This extension of traditional project risk management to maneuvering in the Bermuda Project Risk Triangle will be discussed in Chap. 4.

If we make a decision associated with uncertainty, the decision may have more than one potential outcome or result (where one specific outcome is our plan or what we aim for by making the decision). This is in line with the

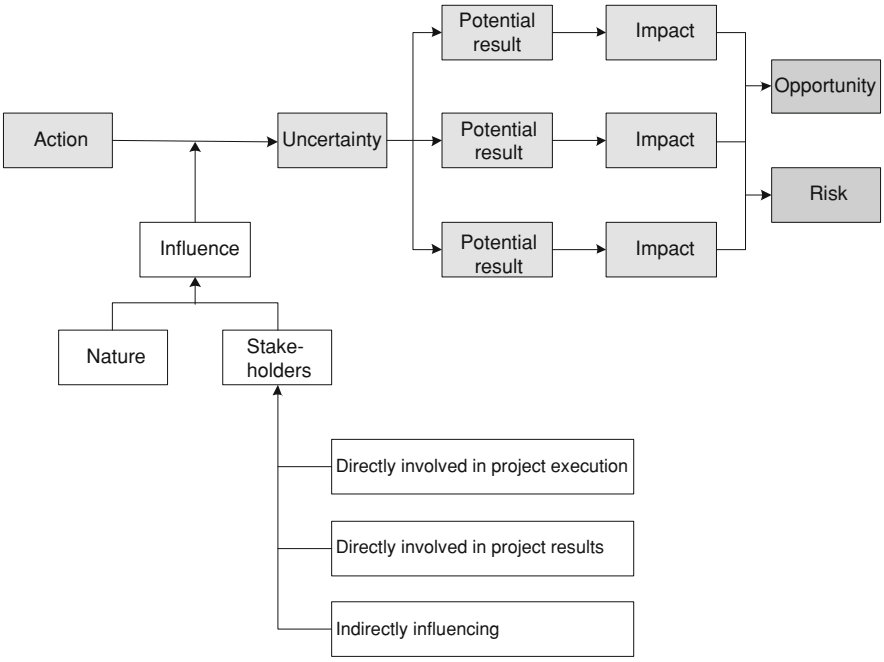

Fig. 3.11 Uncertainty and risk

decision model we showed in Fig. 3.7. Our decision is to take an action which is under our control.

We have illustrated this in more detail in Fig. 3.11. The decision is to take a certain action as shown in the upper left part of the figure. The action is influenced by the non-controllable factors which are split in two categories:

- Nature.
- Stakeholders.

Nature means that it cannot be influenced by any person or organization. It is beyond human control. Any person or organization that can influence the project and its results or is affected by the project and its result is called a *stakeholder*. Stakeholder management (including stakeholder analysis) is an important success factor. We will focus on the following three groups of stakeholders:

- Stakeholders that are directly involved in the execution of the project and thus able to influence project management decisions.
- Stakeholders that are directly involved in the use of the project's deliverables and thus able to influence the extent to which the project's business goals are met.
- Stakeholders that are not directly involved in the project but still can influence the execution of the project and/or the use of the project results.

The influence of these non-controllable factors creates uncertainty. This uncertainty leads to potential outcomes each of which has an impact if it occurs. This again creates risks and opportunities.

In any project, there is an owner (sponsor) and a project organization. The owner uses the results of the project for its business in some way. The project organization is temporarily set up to provide the results for the owner. The project organization works towards a set of objectives that we refer to as *project objectives*. The owner has a different set of objectives connected to the owner's use of the results to create business opportunities. We shall refer to these as *business objectives*. Finally any project has some impact on society at large which allows us also to talk about *social objectives* for a project.

This means that we benchmark against three different sets of objectives:

- Project objectives.
- Business objectives.
- Social objectives.

As an example, a project building a chemical plant would have completion of the plant on schedule, on budget, and ready for operation as its project objectives. The business objectives could be to obtain a market share for the chemical products that the facility will produce, as well as to operate efficiently and safely. The social objectives could be diverse; the municipality could aim for employment opportunities and tax incomes while environmental organizations could aim for minimum pollution and other impacts on the environment.

3.7 Improving the Practice

After the Second World War, a number of techniques for improving productivity have emerged. Many of these came from Japan as part of quality thinking, and many have their background in the automotive industry where the focus was on reducing costs and improving quality and reliability. No stones were left unturned to improve products and manufacturing processes. There are some useful lessons here for project management.

The total quality management concept includes an approach to continuous improvement. Many small improvements on many details would, in total, add up to significant results. In addition to the continuous improvements, there would also be, from time to time, quantum leaps as breakthrough solutions were developed. This is illustrated in Fig. 3.12.

One popular approach to improving project performance is to focus on FEL as explained earlier. This involves comprehensive risk analysis with the aim of freezing up-front decisions as much as possible to avoid unpleasant surprises at the back-end of the project. It is a strategy of trying to predict the future as accurately as possible. Again looking to the automotive industry, high quality and low costs have been obtained through extensive automation. All processes are streamlined

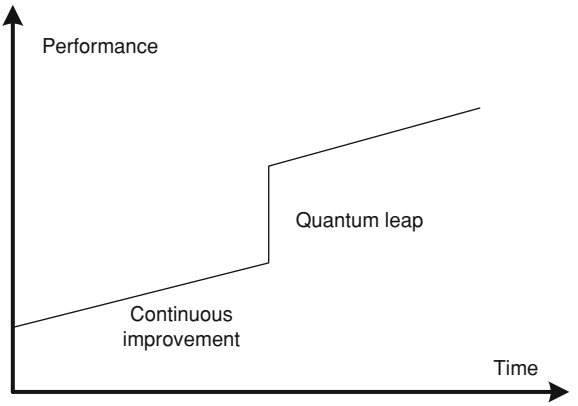

Fig. 3.12 Improvement strategies

and automated and therefore repeated without surprises every time. Is this the same approach one tries to follow in project management through the development of governing documentation, best practices and risk management? If so, the strategy must be wrong. The cars on the assembly lines are the same, but the items in a project outcome differ. Projects must therefore be treated in a different way as no 2 days on a project are the same and no two projects are alike.

FEL tries to lock decisions early. This may avoid surprises at the end, but it may also lead to lost opportunities. To draw an analogy, consider a person going from A to B. Between A and B, there is a huge maze. The risk averse strategy would be to go around the maze. This strategy would involve a very reliable estimate which could be made since there are only a few unknown factors. However, the person taking the risk of entering the maze, might see an opportunity to get through faster, but may also risk being slower. This creates a conflict of interest between *knowing in advance* and *looking for opportunities*.

Looking for opportunities to improve project performance is the same as trying to create a quantum leap. Most work in the project management profession is, however, dedicated to continuous improvement. In this context, newer contributions to knowledge include topics such as

- Maturity of project organizations.
- Agile project management.
- Team performance.

However, there are some recent publications on radically changed thinking. The most promising ones include:

- *The Tipping Point.*
- *The Black Swan.*
- *Blue Ocean Strategy.*
- *Managing the Unknown.*
- *Reinventing Project Management.*
- *Agile Project Management.*

3.7.1 The Tipping Point

In his book, *The Tipping Point*, Malcom Gladwell [8] describes how little things can make a big difference. He uses two examples to illustrate what he calls epidemics in action. One example is from fashion. Shoes that had gone out of style suddenly became bestsellers. The second example is the sudden drop in the New York crime rate during the 1990s. Gladwell compares these dramatic changes to viruses. They represent ideas that have a contagious behavior. These are ideas that involve small changes. However, when they become epidemic, they spread very fast.

Gladwell identifies three characteristics of these epidemics in action:

- Contagiousness.
- Little causes that have big effects.
- Changes that happen at one dramatic moment rather than gradually.

Are there any tipping points in major capital projects? An example from the construction of a new building for the National Bank of Norway in 1975 [17] may cast some light on the problem. The total area requirement for the building grew by 103%. The study that was done afterwards, explained that it was important to be forward looking. The study claimed that all space requirements added would have been included if a new building was erected. This thinking appears to be close to the epidemic effect described by Gladwell [8]. It is also a well-known problem in cost engineering. Clark and Lorenzoni [4] calls this effect *cost blackouts*.

3.7.2 The Black Swan

Taleb [22] in his book about black swans noted that a black swan meets three criteria:

- It is an outlier.
- It carries extreme impact.
- Human nature makes us concoct explanations for its occurrence after the fact, making it seem explainable and predictable.

The black swan logic makes *what you do not know* more important than *what you do know*. Traditional risk analysis tries to predict the future and develop robust strategies to minimize the impact of any undesired event. However, forecasts are normally derived by extending historic trends. Such an approach fails to detect black swans.

Taleb claims that we show aggressive ignorance of the presence of black swans. In planning projects, we are so confident of our data, methods and decisions that we systematically exclude the risks described as black swans.

Finding Black Swans requires looking at the project from a fresh perspective. We must escape from traditional thinking and think unconventionally. We should hunt for black swans. They should not be impossible to find. In hindsight, they are always obvious. However, black swan thinking at the same time demonstrates that unexpected events may happen no matter how much planning we do. Can we really predict all Black Swans? Should we find a way to live with them and just manage risks as they appear?

3.7.3 Blue Ocean Strategy

Kim and Mauborgne [13] have published a book called *Blue Ocean Strategy*. It discusses competition amongst companies and argues for a totally different strategy for survival.

They describe the Red Ocean as a competitive battlefield. All the competitors are in the Red Ocean doing their best to beat each other, for example, by producing at lower cost, by providing product features that surpass those of the competing products in the market place, by focusing on economic growth, etc. The Red Ocean is synonymous with deadly tough competition.

The opposite is the Blue Ocean. In the Blue Ocean are all the sectors or companies that do not exist today. In other words, the Blue Ocean represents the unknown market place which is beyond competition. The Blue Ocean strategy is a strategy to survive by creating new markets and making competition irrelevant.

Most Blue Oceans are created in a Red Ocean by extending its limits. The survival strategy is to escape the Red Ocean and sail into a Blue Ocean. Blue Oceans are created continuously. If we look back one hundred years, how many of the products of today existed then? They have all been Blue Oceans.

The Blue Ocean strategy is to create new markets. How can we apply this strategy to managing mega projects? We claim that most mega projects are competing for management strategies in a Red Ocean. Our solution is to show a way to escape the Red Ocean and create a Blue Ocean. We think that strategies for managing risk in mega projects are of crucial importance to finding the Blue Ocean. However, we need to look beyond the existing Red Ocean strategies.

3.7.4 Managing the Unknown

Loch et al. [16] make a clear distinction between project risk and project novelty. They observed that despite good project risk management tools, more than half of the projects fail to meet their objectives. They claim that the main reason is because organizations do not see the difference between risk and novelty.

Novel projects pose fundamentally different challenges than risky projects. Novel projects are characterized by the unknown–unknown risks (unk–unks).

There may be too many unk–unks or too much complexity in a novel project making it meaningless to make any plans. Plans are still made, but they cannot be realistic as there is too much unforeseeable uncertainty. Thus there is no "real" plan enabling proper application of standard project management techniques.

Loch et al. [16] explain how we can prepare for unk-unks. Although they are unforeseeable, their presence can be detected by diagnosing the gaps in the project team's knowledge about the project. There are two approaches to manage novelty. The first is *learning* in the form of a flexible adjustment of the project approach as one learns more about the project, its environment and its interactions. The second is called *selectionism* which means pursuing multiple approaches in parallel and independent of each other and then making the selection of the best one ex post.

Loch et al. [16] also argue that these two different approaches must be managed differently from each other and from the traditional project planning approach. They see the need for changed mindset and new tools. They describe an infrastructure of a managerial system that can be implemented at the beginning of the project to facilitate learning and selectionism.

3.7.5 Reinventing Project Management

In their book *Reinventing Project Management*, Shenhar and Dvir [19] argue that a new framework for project management is needed. The traditional approach is criticized for being based on a predictable, fixed and certain model, as it is decoupled from changes in the environment and business needs as soon as the project objectives are set and the project plan is prepared. This "management-as-planned" philosophy focuses on an assessment of progress and performance after the project has been launched. Changes to the plan are rare and, if possible, avoided.

Shenhar and Dvir then attack the two cornerstones of conventional project management, *the triple constraint* and the *one size fits all* strategy. The triple constraint, better known as the iron triangle, forces project managers to achieve success only by managing to bring the project to completion as specified, on time and within budget. Deviations to the triple constraint are considered negative and should be avoided. The one size fits all strategy is criticized for assuming all projects are the same and can be managed successfully by following a standard set of activities as outlined in conventional textbooks. Guidelines for how to distinguish between projects and for selecting the right approach are non-existent.

The authors then announce the bad news: most projects fail to meet their goals. Over a period of 15 years, they claim to have collected data on more than 600 projects, of which 85% have failed to meet their budget goals. The average overrun is reported to be 70% in terms of time and 60% in terms of cost.

Shenhar and Dvir then introduce the good news: executives and project managers should accept things as they are. The authors introduce a new framework for project management, *the adaptive project management approach*. According to

this new approach, projects are more than a collection of activities that must be completed as planned. The authors claim that projects are business-related processes that must deliver business results. Projects involve uncertainty and complexity and must be managed in a flexible and adaptive manner.

The authors then present a multidimensional model for assessing and planning project success beyond the triple constraint. This new model addresses five dimensions:

- *Project efficiency*. Meeting time and budget goals.
- *Impact on the customer*. Meeting requirements and achieving customer satisfaction, benefits, and loyalty.
- *Impact on the team*. Satisfaction, retention, and personal growth.
- *Business results*. Return on investment, market share, and growth.
- *Preparation for the future*. New technologies, new markets, and new capabilities.

To address the premise that projects are different, Shenhar and Dvir present a complementary model, *the diamond approach.* According to this model, projects are classified according to scores on four different dimensions:

- Novelty—uncertainty related to how new the project's product is to customers, users and the market in general.
- Technology—uncertainty related to how much new technology is needed.
- Complexity—related to the product, the task and the project organization.
- Pace—related to the urgency of the project and how much time there is to complete the job.

Projects are then plotted and characterized in a diagram representing the four dimensions which are subdivided into three or four levels of increasing aggressiveness. By means of such a diagram, the level and nature of project uncertainties and risks are visualized.

3.7.6 Agile Project Management

In his book, *Agile Project Management How to Succeed in the Face of Changing Project Requirements*, Chin [2] claims that projects can be successfully completed in changing environments if project managers move from a focus on planning to a focus on execution which accommodates the changes as they occur:

> This is not to say that the areas of project definition and planning will be ignored, just that their focus will shift to supporting decisions during project execution rather than making them all up front.

Chin makes a distinction between internal and external uncertainties. The internal uncertainties involve things that can be controlled by the project manager, including scope, time and cost. The external uncertainties refer to

factors outside the control of the project manager, such as the industry's business environment, the competition and business strategy decisions. According to Chin, internal uncertainty depends on the type of project. Internal uncertainty is low for operational projects and high for technology development projects. Unlike internal uncertainty, which is more a function of company maturity, external uncertainty is largely a function of industry maturity. While mature industries have weeded out much of the competition and erected barriers to entry for newcomers, emerging industries have many small companies vying for position, causing a lot of rapid change. As more uncertainty is introduced to these previously mature and stable industries, the classic project management methods are stretched. At some point you start looking for new ways of running projects in an agile manner.

Chin defines an agile project management environment as a combination of uncertainty, unique expertise and speed. He illustrates this by contrasting agile and classical approaches to managing projects. The bottom line contrast is that, in the agile environment, *projects are the business*, while in the classical environment, the triple constraint of scope, resources and schedule, is the prime concern.

In an agile strategy, the project manager takes an outward-facing perspective to facilitate the integration of the project and the business. Focus is on delivering business results rather than staying within preset boundaries, as the original project boundaries will quickly diverge from the business reality in an uncertain environment.

Chin then explores how the agile strategy is applied to project team development. When defining roles and responsibilities in an agile environment, boundaries should be used to guide team members rather than erecting barriers to restrict their freedom to act. Team members are encouraged to cross boundaries while not being intrusive. The team is urged to identify and create synergies among related and seemingly unrelated parts of the project.

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Chapter 4
A New Approach to Project Risk Navigation

4.1 An Extended Project Risk Concept

In the preceding chapter we have discussed the shortfalls of the current project risk concept. We have shown that, despite managing projects by the book, following advanced risk management techniques and applying the phase-gate concept, cost overruns and delays still occur. We will now advocate some fresh thinking on project management approaches and then show how this leads to an extended project risk concept comprising three different categories of risk.

Projects today are not solely defined as a set of specified deliverables; rather they have become a means to enhance business value. A close interaction between corporate and project management is not only expected but is encouraged. Corporate management wants to drive project business value in all phases of the project; hence there is a need for "offensive" or explorative strategies whereby project objectives as well as project boundaries are continuously challenged. This new trend increases project uncertainties and risks; hence risks have to be managed dynamically instead of being reduced or eliminated. We refer to this category of risk, illustrated in Fig. 4.1 by the overlapping domain of corporate and project management, as *operational risks*.

As corporate management continuously adapts to changing environments by revisiting current strategies, changes will be made that affect project objectives and strategies. We refer to this category of risk, illustrated in Fig. 4.1 by the overlapping domain of corporate management and environment, as *strategic risks*.

As projects today are often executed in rather turbulent environments, project management will continuously have to adapt the project execution process to cope with impacts from events taking place in the project external environment. We refer to this category of risk, illustrated in Fig. 4.1 by the overlapping domain of project management and environment, as *contextual risks*.

The distinction between operational, strategic and contextual risks has also been addressed by Rolstadås and Johansen [3] who argue for a shift from protective to

A. Rolstadås et al., *Risk Navigation Strategies for Major Capital Projects*,
Springer Series in Reliability Engineering, DOI: 10.1007/978-0-85729-594-1_4,

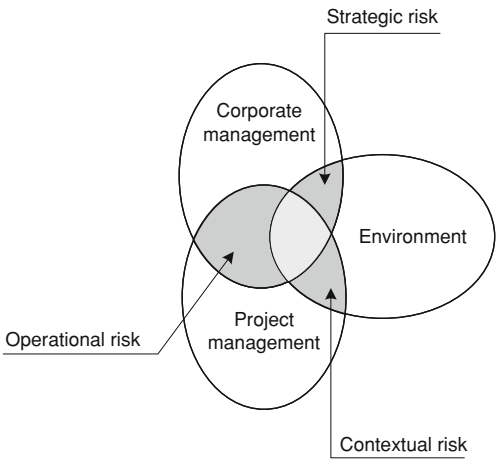

Fig. 4.1 The extended project risk model

"offensive" project management. We will explain these risks in more detail in Chap. 6.

4.2 Improving the Risk Climate

There is a strong belief that more focus on risk management is a key factor to project success. We do not disagree but we believe that the approach commonly applied as best practice today fails to address several important aspects and consequently creates an over-focus on some areas which may lead to lost opportunities.

In many respects, it seems that the industry has created a climate characterized by risk aversion. This climate is well supported by media who focus on project deviations and often ignore the nature of uncertainty and risk. This climate has to change if we want to improve project performance. The traditional tools for managing projects have probably exhausted their potential for completing projects on time and within budget.

We could ask ourselves "What are the most important objectives to reach?" Is it the project objectives, focusing on delivering a facility on time and budget, or could it be maximizing business value creation in a longer term perspective? Could there be situations where increasing the project cost or duration by benefiting from an emerging (unexpected and unforeseen) opportunity could improve business value creation?

Projects are dynamic by nature. This means that no project goes exactly as planned. This does of course not mean that we should stop planning. It means that we should accept deviations during project execution. We may be able to gain a better payoff if we learn to manage these deviations as we go along rather than trying to freeze all decisions up front. If we accept the dynamic nature of projects, why do we insist on managing them as some static and fully predictable activity?

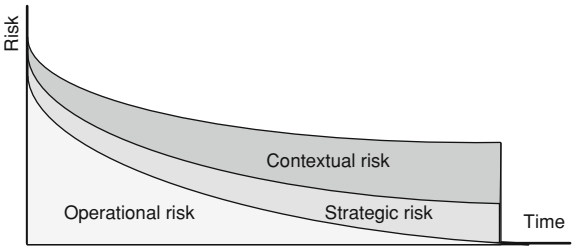

Fig. 4.2 Risk development over project life

The business world is willing to take risks. Any finance manager investing in projects understands there is risk involved. He or she would like to invest in a portfolio that maximizes their return on investment. This is well illustrated in real option theory [1]. Through a real option, the investor buys a right (but not an obligation) to rent or buy a financial asset at a later time allowing her to postpone a decision to some future date. The investor pays a premium for this flexibility. Later, when the decision is to be made, the risk involved is most probably reduced and a better decision can be made. This creates added value compared to making the decision up front with higher risk. If this potential added value is larger than the premium, the option is profitable.

We believe that project planning could benefit by adopting some of this thinking. Rather than predicting everything through comprehensive front end loading studies, we should develop options and use real option theory to maximize the total value of the project. Real option theory focuses on market risks and tries to quantify these by assigning beta values to the risks. This approach is different from accepted project management practice.

An improved risk climate would involve taking advantage of the fact that an uncertain event can return both a positive and a negative occurrence. For example, an uncertainty is the price of a service which may end up with a cost saving if there is a drop in the market. For a project that needs a service contract in, for example, 12 months, the project manager could enter into this contract today or could wait another 6 months. In those 6 months, the price may be the same, higher or lower.

We have argued that it is not sufficient to look at operational risk. Strategic and contextual risks are just as important, but often neglected.

Krane [2] has studied to what extent risk management includes both threats and opportunities, based on seven case studies. He observed from the detailed risk register studies that most of the projects obviously had made an effort to find opportunities. This supports the impression of the authors' observation that the project risk management profession has improved considerably as to how it views risk and opportunities. Krane [2] also examined the distribution between strategic and operational risks for the seven projects studied. Overall, far more operational risks than strategic risks were identified in the seven projects.

It is well accepted that risks vary over time. Most authors discuss operational risk and paint a picture where it is gradually reduced to zero as indicated in Fig. 4.2. The figure also shows strategic and contextual risks. It is important to

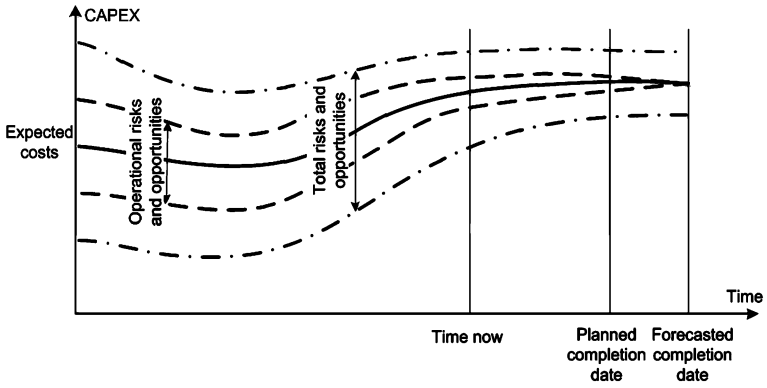

Fig. 4.3 Combining levels of risk with continuous forecasts of final project costs

note that the strategic and contextual risks may have a residual value by project completion. This residual value cannot be eliminated by conventional risk management approaches. In fact, it cannot be eliminated. However, it may be exploited. The residual value represents a kind of volatility in managing the project.

The graphs in Fig. 4.2 illustrate levels of threats represented by operational, strategic and contextual risks. During project execution, some of these threats materialize and damage project objectives, causing quality defects, delays and cost increases. Defects in quality have to be corrected resulting in delays and/or increases in capital costs. Some delays may be recovered but again at additional costs.

As the graphs in Fig. 4.2 only represent the remaining threats and opportunities at any point in time, the level of risk is likely to reduce as the project moves towards completion. To have a complete picture of the project risk implication we therefore need a representation of the development of forecasts for final costs and the levels of threats and opportunities in the same diagram as we illustrate in Fig. 4.3.

In Fig. 4.3 the centerline represents the development of expected CAPEX from project sanction to completion. As can be seen, the centerline fluctuates to accommodate the impact of threats and opportunities as they materialize.

The levels of threat are likely to diminish if we disregard the identification of black swans. Black swans may affect the project objectives and often have a huge impact on the corresponding business objectives. On major capital projects, black swans are rather common. In addition to black swans there are *white swans*, representing unforeseen opportunities at project sanction. The white swans are everywhere; we see them but we do not see them.

The traditional focus is on identifying black swans and taking them out before they can cause too much damage to the project. For convenience, we could refer to an action to take out a black swan as an *eagle*. The *eagle* is a well-known defense strategy in American football. It provides the defending team with the ability to

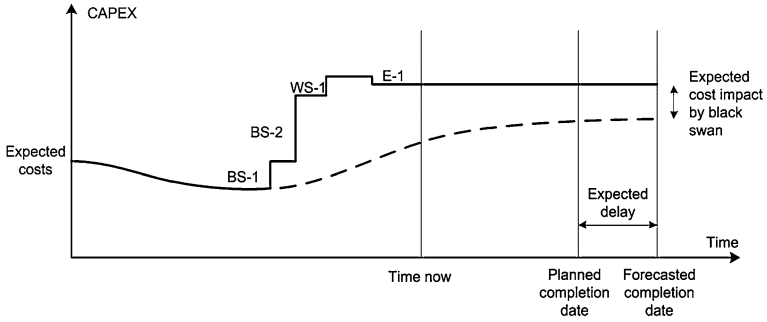

Fig. 4.4 The implication of black swans to an offshore gas producing platform

quickly adapt to an unexpected offensive play. In an organizational context, *resilience* is used in a similar manner to the eagle in football. In the following we will use the term eagle to identify the action released to take out an observed black swan while resilience will be used as the organizational capability to search for black swans and to launch eagles as appropriate.

A non-traditional strategy is to look for and to exploit opportunities represented by white swans. For convenience, we refer to such a strategy as a *scrum*. A *scrum*, or more accurately, a *scrum-sprint*, is a well-known attack strategy in rugby and has recently been applied to some areas of project management. In an organizational context, *agility* is used in a similar manner to scrum in rugby. In the following we will use the term scrum to identify the release of an attack to exploit a white swan while agility will be the organizational capability of identifying and targeting white swans to be attacked and exploited.

Though we focus on project risks and strategies to handle such risks, rather than to exploit opportunities, identification of white swans and launching of scrum teams often occur in parallel as part of a comprehensive project risk strategy. The occurrence of black and white swans and eagle and scrum strategies is illustrated in the following example: the construction of a major gravity based concrete platform for production of natural gas offshore Norway.

Our point of departure is Fig. 4.3 illustrating the continuous forecasting of final costs together with levels of threats and opportunities, disregarding black and white swans. In Fig. 4.4 we introduce the implication of black swans in terms of damage to project completion and to CAPEX. The threat levels are omitted in the figure for simplicity reasons.

As illustrated in Fig. 4.4, the line representing expected final costs vary, both in terms of:

1. Minor adjustments for incurred and potential risks identified as known risks.
2. Vertical jumps representing damage caused by unexpected unknown risks identified as black swans.

The first vertical raise in costs Black Swan-1 (BS-1), represents the damage caused by a major labor dispute at a South European yard. The yard had been

awarded a contract for construction and outfitting of a large module for the platform's top facilities. As the yard soon was to run out of work, the laborers launched a strike to put pressure on the client to award new contracts.

A delay in shipping the module to the assembly site for topside facilities in Norway would threaten the time planned for positioning topside facilities on top of the now floating gravity base concrete substructure in a West-Norwegian fiord, an operation needed before towing the platform to its offshore location. Missing the weather window for offshore towing operations would prevent towing the platform to its location in the current year and would also postpone the start of gas production by a minimum of 6–8 months.

In Fig. 4.4, the first vertical jump, the labor dispute, originally consisted of an assessment of two possible resolutions to the problem:

- Accepting a significant delay in finishing the project caused by late completion and late arrival of the module.
- Cancelling the order, enforcing a major claim against the contractor and ordering a new module at another yard.

The second solution would at least result in a 1 year delay in the start of production. Due to the severe nature of the labor dispute, the first solution was based on the assumption that a delay in the completion of the topside facilities at the Norwegian assembly yard would be long enough to cause the weather window for towing the platform to its offshore location to be missed. Another concern was that it might be impossible to get the module out of the South European yard; hence a new module would have to be built as a result of the labor dispute. As illustrated in Fig. 4.4, the first black swan (BS-1) affected the CAPEX significantly and further led to a substantial delay in forecasted project completion.

The client's project team did not, however, resolve the problem caused by the first black swan before they were hit by another one, illustrated by the second vertical raise (BS-2) in Fig. 4.4. This time the gravity base structure, nearly completed, collapsed during an inclination test in a Norwegian fjord. The collapse proved to be fatal as a large number of structural components were spread all over the sea bottom and could not be recovered economically, hence referred to as *sunk cost.*

The incident occurred at about 8 a.m. Then something peculiar in the history of project management happened. Less than 2 h after the structural collapse, the project sponsor claimed that the project director was the best person to cope with the extremely critical situation that had occurred. Instead of reducing his influence, the project director's financial authority was raised considerably enabling him to cope effectively with the extremeness of the situation.

The project director immediately put together a scrum team to attack the potential damage caused by the second black swan. At about 6 p.m. the same day, a solution to the problem was found by the scrum team. A white swan (WS-1) of significant potential value had been identified. In essence the solution was:

1. Order a duplicate gravity base structure.
2. Add a simple riser platform, a steel jacket, to the offshore field center, enabling gas to be supplied temporarily from a complementary reservoir while waiting for the originally planned platform to be rebuilt.

The second black swan hit the project objectives as constructing a new gravity base structure would add CAPEX and delay the project completion date by 2 years. Some of the additional costs were expected to be recovered through an insurance claim. The construction of the steel jacket, however, would add additional costs that would damage the project objectives even more. This cost increase enforced by the scrum team is indicated by the vertical jump WS-1 in Fig. 4.4.

The rationale for building a jacket was to ensure a supply of huge quantities of gas to France according to commitments laid down in a major gas sales contract. The solution, found by the scrum team to identify and exploit a white swan, significantly reduced the strategic and contextual risks caused by the second black swan. If successful, the corrective action taken would considerably improve the project business objectives. The type of platform to be added, a simple steel jacket structure, was well known to a number of contractors in the North Sea area. There was, however, one major obstacle as the jacket would have to be built in half the time normally taken. The team launched a smart operational approach comprising:

- Reuse of calculations, drawings, material take offs.
- Extensive use of materials already available.
- Waiving practically all bid procedures.

This enabled the project team to actually succeed in cutting the standard construction time by half. No one had thought much about the cost of the smart procedure. Therefore, it came as a surprise that the actual costs came in slightly below the standard cost for such a project.

The collapse of the gravity base structure implied that the module under construction was not needed for a long time. The project organization now had sufficient latitude to spend the time needed to find a solution to the problem. The laborers no longer had the same power as the completion and delivery of the module was not urgent anymore. Finally, a compromise was found and the module was completed as originally contracted. The client accepted some additional costs as the contractor was awarded additional non-critical work for another project. However, the originally anticipated cost damage caused by the first black swan was significantly reduced. In Fig. 4.4, this achievement, trading the completion of the module under construction with some additional work, is represented by an eagle (E-1).

The implication of the black swans and the corrective measures taken to handle the project business risks is illustrated in Fig. 4.5.

Comparing Fig. 4.5 with Fig. 4.4 we see that actions taken by the project team, such as adding a jacket structure (WS-1), add CAPEX but significantly improve on the business objectives. Therefore the corrective actions should not solely be enforced based on operational risks. The strategic and contextual risks must also be evaluated to arrive at the best solution to the problem.

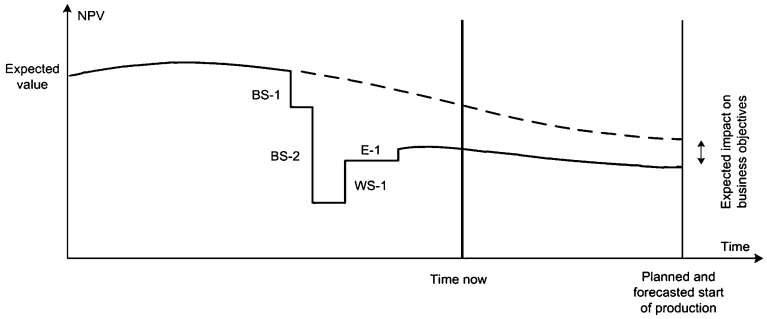

Fig. 4.5 The implication of black swans and remedial actions taken to secure the project business objectives

Table 4.1 Stakeholders and risks

Type of stakeholder	Objective influenced	Category of risk	Financial risk
Directly involved in project execution	Project objectives	Operational risk	Private
Directly involved in project results	Business objectives, project objectives	Strategic risk	Market
Directly or indirectly influencing	Social objectives, project objectives, business objectives	Contextual risk	

Table 4.1 links the different types of objectives for the various types of stakeholders (see Fig. 3.11) that could influence the project outcome. The stakeholders directly involved in the *execution* of the project influence the project objectives. The corresponding category of risk created by these stakeholders is *operational* risk. The stakeholders directly involved in using the results of the project mainly influence the business objectives, but may also influence the project objectives. The category of risk created by these stakeholders is the *strategic* risk. All other stakeholders that are directly involved may influence any objective including the social objectives. The associated risk is the *contextual* risk.

Finance literature uses a different classification of risk, distinguishing between two major categories:

- Market risk.
- Private risk.

Risks that can be captured in the value of a traded security constitute market risks. All other risks are private risks. The market risk of a project may be due to the volatility of the expected future payoff driven by market forces. For investors, market risk is diversifiable by investing in portfolios of independent projects. Private risk is the financial impact of project endogenous uncertainties, i.e. uncertainties that are not correlated with market events. The private risks are

related to the efficiency of the project organization as well as the effectiveness and usefulness of the project results. Private risk may, in many cases, be the same as technical risk. In Table 4.1 we have also shown how our three categories of risk compare to these financial risks.

Implementing an improved climate for risk driven decisions requires a change in mindset. The main drivers for such a change are:

- Moving from risk aversion to risk navigation.
- Looking for the opportunities created by uncertainty in decisions.
- Using real option thinking to postpone decisions for improved quality (reduced risk).
- Exploring and capitalizing on strategic and contextual risks.
- Training project managers in risk understanding and trusting in their ability to make good decisions.

4.3 Overview of the New Approach to Project Risk Navigation

We have argued that the current thinking in risk management is not preventing cost overruns and schedule delays and that new concepts are needed to improve this situation.

In Fig. 4.1, we showed how the extended risk concept (operational, strategic, and contextual risks) interfaces with corporate management, project management and the environment in which the project is executed. If we compare Fig. 4.1 with Fig. 3.6, we see that projects are not designed to be executed on an isolated island anymore, where risks are solely handled through a combination of a no-change philosophy and protective barriers towards the outside world. In the extended concept explained here, overlaps between the project, corporate and environmental domains are acknowledged. Hence the need for a wider spectrum of navigation strategies is recognized, one that encompasses explorative, adaptive and delivery-oriented foci.

Figure 4.6 shows again Fig. 4.1. The overlapping of the three domains creates an "ocean" containing the different types of project risk (operational, strategic, and contextual). We refer to the ocean as the *Bermuda Project Risk Triangle*. Just as travel in the area of the Atlantic Ocean known as the Bermuda Triangle requires one to accept unknown risks, so too does the multi-year duration of a major capital project.

To navigate this ocean, the project manager needs to take a three legged journey as illustrated by the three arrows: explore, adapt, and deliver. We are using this metaphor of a journey to illustrate the change process that the project manager will have to take to shift his mindset to navigate in the Bermuda Project Risk Triangle.

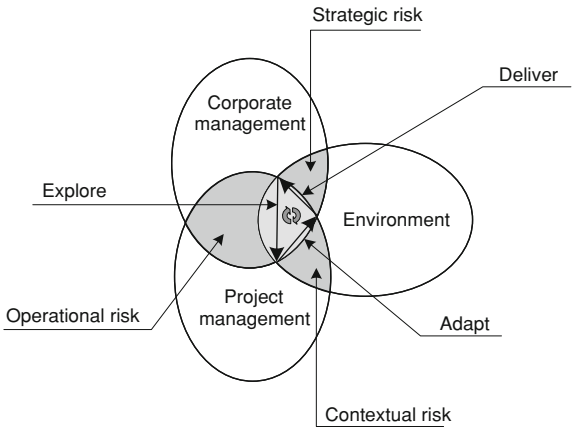

Fig. 4.6 The "Bermuda Project Risk Triangle"

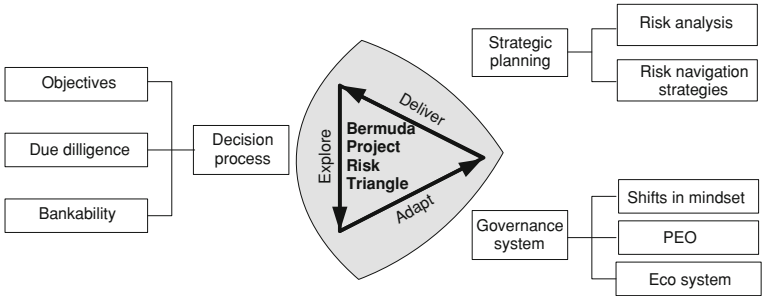

Fig. 4.7 The "Extended Project Risk Navigator" and its components

This shift in mindset is one of the important aspects of the new risk navigation strategies to be introduced later.

We elaborate on the Bermuda Project Risk Triangle (the ocean) and the change process (the journey) in Chaps. 6 and 7 in Part II.

Project risk navigation is about how project leaders can navigate in the Bermuda Project Risk Triangle and reach their objectives. Figure 4.7 shows the Extended Project Risk Navigator. This navigator is presented as a framework containing three major components (briefly defined in Chap. 2). The components are:

- The governance system.
- The decision process.
- The strategic planning.

These are all crucial aspects already present in modern project management. We propose modifications and extensions that will pave the way to a new generation of project leaders able to implement new project risk navigation strategies.

The governance system includes *shifts in mindset*, introduces the role of a *Project Executive Officer* (PEO) and outlines the *project eco-system*. To obtain

Table 4.2 Comparison of old way and new approach to manage project risk

Concept	Traditional way	New approach
"Context"—the environment in which the project will be executed	Project context typically or mostly ignored.	The context is recognized as critical to project success.
"Perception of risk"	Evil—to be avoided or transferred wherever possible	Unavoidable—a variable to be managed …risks must be expected, understood and managed. Know that the risk owner is best positioned to "own"
The Responsibilities of management for project success	Management holds project teams and contractors responsible for achieving outcomes as premised at sanction	Management plays an active role in addressing contextual and strategic risks, ensuring organizational effectiveness, and being willing to make timely decisions under uncertainty.
"Discipline and consistency"	Phase-gate approach is defined and applied with discipline and consistency to all projects, regardless of context/risk exposure	Flexible approach allows each project's decision gates and work program to be designed in accordance with context, strategic risks, real options, etc. Open systems are accepted. Check options/changes in the environment prior to major commitments during execution
"Front end loading"	Complete FEL is assumed to provide predictability at sanction. Goal of locking everything in as defined up-front precludes creativity and adaptability as the project progresses and situation changes. "Flight plan" is fixed. Changes are anathema	Flexibility is preserved as the project progresses … proactive approach to strategic and contextual risk management … intermediate decision points during execution. Recognize that projects will have varying degrees of maturity at sanction, that strategic risks and volatility are not correlated with time or progress
PM mindset	Define a plan and stick to it. Define objectives and stick to them. Define the scope and do not change it	Move to a dynamic, adaptable mindset … recognize that the context and strategic risks, business goals, etc. may all change and require adaptation. Fuzzy objectives are appropriate in many cases
Planning mindset	Plan across the entire project—set milestones and expectations for completion	Perspective on Master Plan which is strategic but understood to be uncertain; prepare plans for near term objectives based on points of inflection
Changes and variations	Root of all evil	Opportunities for improvement—preserve flexibility

shifts in mindset, a change process is needed. The new approach to the governance system is discussed in detail in Chap. 8 in Part II.

The decision process includes *objectives*, *due diligence* of the plans and a determination of *bankability*. The decision process is discussed in detail in Chap. 10 in Part II.

The strategic planning includes *risk analysis* and the preparation of appropriate *risk navigation strategies*. The strategic planning is discussed in detail in Chap. 10 in Part II.

In summary, the New Approach to Project Risk Navigation that we present includes:

- The notion of the Bermuda Project Risk Triangle including operational, strategic and contextual risks.
- A change process leading from exploring via adapting to delivering (illustrated as a journey).
- A framework for the Extended Project Risk Navigator containing the three main components: Governance system, Decision process, and Strategic planning.

Table 4.2 summarizes the main differences between the traditional way of managing project risk compared to the proposed new approach. The first column lists a number of known concepts. The two last columns indicate the main differences between the traditional way and the proposed new approach.

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Part I
Summary

We introduced a new approach for risk navigation. We see this as a compliment to the current state of art in risk management as practiced by the industry today.

We see a need for a new approach since mega-projects still suffer from cost overrun and severe delays. We argue that the current approach of trying to improve the predictability is not solving the problem, and that a radical new way of thinking is required. Instead of looking at uncertainty and risk as evil, we need to look at this as the normal situation and develop new methods for managing these risks.

In Chap. 2 we exposed the myth of predictability and showed that there are strategic and contextual risks that need to be addressed in addition to the conventional operational risks.

In Chap. 3 we briefly explained the current thinking in project risk management and showed the need for an improved practice. There are barriers between corporate management, project management and the project environment created by conventional project risk management. We show how these barriers can be broken thus allowing a more holistic view on managing risk.

Risk is introduced through decisions. We therefore explore the mechanism of decision making to understand the influence on the risk picture. We also explain the difference between uncertainty, risk and opportunity. We discuss other relevant publications showing radical new approaches. They are all relevant and represent important steps on the road to understanding the nature of project risk management.

In Chap. 4 we define the new approach. We introduce the Bermuda Project Risk Triangle. Breaking the barriers between corporate management, project management and the project environment introduces new types of risks. We define three categories of risk: operational, strategic and contextual and discuss how the risk climate can be improved. We argue the need for a change process that we illustrate as a journey in the Bermuda Project Risk triangle. Finally we develop a framework for how to navigate in the Bermuda Project Risk Triangle. We call this framework the Extended Project Risk Navigator.

The framework contains three main components:

- The governance system
- The decision process
- Strategic planning

In Part II we will define these components in further detail as we study risk navigation strategies.

Part II
Risk Navigation Strategies

In Part II we discuss in detail the new approach to project risk navigation. We start with a metaphor as an introduction to the basic thinking of project risk navigation. The metaphor is George jaywalking in a large city with heavy traffic. To get across, George explores, adapts and then delivers (moves).
The new approach includes:

- The ocean, which we refer to as the Bermuda Project Risk Triangle, contains the extended risk picture
- The journey to a shift in mindset which we refer to as the change process
- The navigation strategy which we refer to as the Extended Project Risk Navigator

The Bermuda Project Risk Triangle contains three categories of risk: operational, strategic, and contextual. We elaborate on each of these.

The change process has three steps: explore, adapt, and deliver. We discuss project execution models along a timeline starting with the past, going to the present situation, and forecasting the future. The change process is illustrated as a journey on a subway. Three stations are explained and the transition process discussed.

The Extended Project Risk Navigator has three main components: the governance system, the decision process, and strategic planning. These three components are further broken down and discussed.
This Part II covers:

Jaywalking With George
Expanding the project risk concept
The change process
The governance system

- Shifts in mindset
- The Project Executive Officer (PEO)
- The project ecosystem

The decision process
- Objectives
- Due diligence
- Bankability

Strategic planning
- Risk analysis
- Risk navigation strategies

Chapter 5
Jaywalking with George

5.1 Introduction

In Chap. 3 we argued that the current approach to project risk management does not prevent major deviations from the initial project objectives. The underpinning idea in the classical approach is to identify risk factors, evaluate and analyse them and finally try to manage them. We refer to this as a Red Ocean strategy as defined by Kim and Mauborgne [1] in their book *Blue Ocean Strategy*. Project managers are fighting a battle to minimize risk by thinking of as many risk factors as possible. The more sophisticated, the better; and at the same time they move deeper into the Red Ocean.

To improve the forecast of what is going to happen, we must develop better techniques. We may apply mental techniques for dealing with qualitative factors; we may develop scenarios to better see consequences of potential development trends; and we may run sophisticated computer simulations after having provided estimates for uncertainty distributions. The more sophisticated, the more the approach resembles a computerized war game. The similarity with a battle in the Red Ocean is quite apparent.

Despite accurate and advanced analysis, unexpected events happen and impact the project execution. The Red Ocean battle is accelerated bringing hired professional troops on board. These troops act as "risk doctors" and use their best expertise to even more accurately predict the future.

This traditional approach focusing on predicting as accurately as possible what is going to happen is aimed at establishing a kind of bandwidth within which one can expect project deviations. In this world, front end engineering is important, and sophisticated tools for assessing and analysing risk are frequently applied. There is, of course, nothing wrong with these tools. The problem is that they only address operational risks. In Chap. 3 we have shown that there are strategic and contextual risks to be managed as well.

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Traditional project management expects and assumes that we have the ability to understand and plan the future with accuracy. It also assumes that project managers and project management professionals can plan, anticipate risks, estimate cost and schedule to minute detail and that:

- Rigid organizations and procedures are necessary to limit scope change.
- Rigid project control results in increased predictability.
- Projects and risks are adequately predictable through complex and detailed up-front planning and by using sophisticated techniques.

These assumptions have become a huge challenge when it comes to executing major capital projects. According to Wysocki [2], industry practices have shown us that, although we always attempt to control, we always fall short of expectations in terms of cost and/or schedule. The more companies try to control, the more they tend to fail. Wysocki [2] also claims that:

> For every major decision we make, we are always short of information. This creates a bounded rationality within which we have to operate. Yet we constantly over-estimate our ability to plan. Project management practices have become ritualized myths. One of the most outrageous of the managerial myths is that one can anticipate and predict the future with significant accuracy.

It is obvious that the current industry practices for delivering projects no longer work in the current project environment where the types and occurrence of project risks are continuously changing and therefore cannot be accurately quantified or controlled. The failure of long-term thinking is evidenced by the many examples of major capital projects everywhere not being delivered in accordance with their original expectations.

This has created an urgent need for a change in the current practices and for a different management approach when working on major capital projects. It is time for organizations to accept the collaborative and flexible approach of near-term thinking as a better way to understand the capital project environment and its challenges.

Near-term thinking is built on the assumption that, when experienced people work together collaboratively, they can develop realistic and practical plans about the future and can respond to project realities and react to changing project environment to make predictions about the near future. Winston Churchill said that "*Only one link of the chain of destiny can be handled at a time*" [2].

We will argue that everything need not be fixed by the launch of the project. Actually, postponing decisions and releasing individual creativity might create opportunities on which the owner can capitalize. This also creates risks, but hopefully these risks can better be assessed and managed when they are closer in time rather than at a distant future [2]. An analogy with George, the jaywalker pedestrian in an overseas location, will illustrate, in the next section, near-term and just-in-time thinking.

5.2 George, the Jaywalker

George recently attended a project management conference in a developing country and found himself facing chaotic traffic as a pedestrian. His experience in crossing a 6-lane highway provides some useful insights into risk navigation. What strategy should he use to cross the highway? Traffic is heavy and moving fast, with no interruption. Cars and trucks, large and small, are all moving aggressively. And, there are no pedestrian crossings or lights where traffic is obliged to stop.

Traditional risk management is perhaps analogous to a street with pedestrian crossings and traffic lights. Risks are anticipated well in advance, mitigation strategies are put in place and rigorously followed. For those crossing at the intersection, risks are well-managed and the outcome (safely reaching the other side) reasonably predictable. On the other hand, those who have an urgent need to cross elsewhere must deal with a totally unstructured situation where the risks can be very high. Conventional risk management often fails when a project encounters risk factors which were not anticipated; here is where the lessons of the developing country pedestrian are useful.

As he contemplates his challenge, George first recognizes his goal is to get to the other side—safely and in a reasonable time. Then he recognizes that, unlike a similar situation in Canada, the time it will take, the path he will take and where he will end up are all uncertain and unpredictable. If he is to cross safely, a conventional approach to pedestrian risk management will not suffice; he must navigate appropriately.

George quickly develops his risk navigation plan.

- He assesses the situation and considers the overall risk factors:

  Weather. Is the road slick, can cars stop quickly?
  Visibility. Can he be seen?
  Time of day. Is the amount of traffic likely to increase or decrease?
  Level of traffic. Light or heavy?
  Speed of the traffic. Fast or slow?
  His own capabilities to react and move quickly. Is he alone, or with a child or an elderly person?
  The importance of time and the associated level of acceptable risk. Is he going to a birthday party or to the hospital?

- He determines his alternatives:

  Wait for the traffic to die down
  Move to a different crossing point
  Walk to a taxi stand and go by taxi
  Navigate a safe crossing from his current starting point

George knows there is a risk of being run over; uncertainty as to how long it will take to cross and where he will end up; but also the opportunity to cross the highway when and where he pleases. He knows that, once he begins, there is no

turning back, and that the long term outcome depends on his ability to adapt rapidly and make the right near-term decisions. (The parallel to project management is, of course, obvious.) He knows that, while he has a plan, his survival depends on his ability to change that plan as circumstances change.

Now he proceeds in the great tradition of the "developing country" pedestrian:

- George steps boldly out into the first lane, making eye contact with the first oncoming driver before moving across the first lane.
- He then ignores the first driver to make eye contact with the oncoming driver in the next lane. Instantly he decides whether to go forward, to stay put for a second, or perhaps even to move sideways.
- He continues this process as he crosses the remaining lanes, relying on quick reactions and intuitive decisions to keep going.
- Sometimes he moves more slowly and waits; sometimes he darts quickly. Although he is aware of the overall (long term) goal, he works within near-term objectives (looking at only one car and one lane at a time) since this is the only thing that is manageable—and to take his eye off this would get him killed.

This is a good illustration of risk navigation and why it requires a new type of thinking and organizational behavior: being comfortable with uncertainty and adaptive to changing situations.

If George had attempted this crossing using the traditional approach to project management (making a plan and sticking to it) he would either get killed or be stuck on the side of the road for hours.

The following section describes near-term planning in more detail.

5.3 Near-Term Thinking

The concept of near-term planning accepts that project plans are developed just-in-time without looking too far ahead. It is built in short segments throughout the project life cycle. The overall budget and final completion date are specified at the outset by senior management or business unit but the detail is developed piece meal.

We still follow the basic project development and execution process (project phases) i.e., we must identify and assess business opportunity, evaluate alternatives and select the best development plan, define the project, sanction the project, execute the project, monitor and control the results. The manner in which these steps are planned and accomplished are different and require senior management to lead and support a shift in thinking to being flexible and more focused on the near-term.

Near-term planning is an ongoing process, initially starting at a high level major milestone within each project phase and ending with a micro-level activity and task-based work breakdown structure (WBS). This just-in-time planning eliminates speculating on future details because such speculation is waste of time and

effort. This suggests that our detailed planning only includes what we know to be factual. Therefore planning is done in segments where each chunk represents work that will require only a few weeks to complete [2].

Project planning begins by plotting all the major milestones and sub-milestones for the entire project then followed by establishing time segments between milestones. A segment is a planning and scheduling duration and should be several weeks long in duration to maintain steady achievement of milestones and deliverables on a regular basis. We propose the following steps as a guide:

1. Plan and schedule in detail several weeks ahead, not several months.
2. Do high-level scheduling for future phases. Detailed planning can start for the segment at hand with less detailing done for subsequent phases.
3. Organize the project into short segments between milestones within each phase of the project.

   Divide the project into phases
   Divide each phase into its major milestones
   Add sub-milestones to provide reasonable and practical duration for segments
   Provide detailed planning for each segment

4. Produce high level Gantt charts and weekly task lists. Gantt charts are sufficient and projects do not need complicated critical path method computerized systems with thousands of tasks and activities to be successful.

A detailed WBS for the entire project is not needed. The complete WBS will eventually be generated for each segment, one at a time when we need it and not before, and when we do generate the WBS for each segment, we will know that it is reasonably accurate and not a wild guess.

At the completion of each time segment, according to Wysocki [2]:

- *The project team reviews what has been achieved and adjusts the plan and the scope going forward. At the completion of a segment, the team has an opportunity to correct the direction of the project based on what was learned from all previous segments. This constant adjustment means that a project's course is constantly corrected to ensure the delivery of the maximum business value as set by senior management and business units in the organization. In other words, change is welcomed, not avoided.*
- *With everything in place and understood by the team, work begins and progress and risks are monitored during each time segment. Adjustments are made as necessary to quickly react to different situations and risks.*
- *Using this approach means that project planning is done just-in-time without wasting effort on planning and scheduling future components that are never followed. This is an efficient and effective way for project planning and represents a shift in thinking in the capital project delivery.*

We also agree with Wysocki [2] when he asks: "Why plan the future when you do not know what it is?"

As stated earlier, everything need not be fixed by the start of the project. Postponing decisions to the last possible moment might create opportunities on which the owner can capitalize and reap benefits. This approach also creates risks, but these risks can better be assessed by the project team.

We have found that project alignment and an interactive planning process are most critical for the development of and commitment to project plans. It is a simple process. The team is assembled to work together and to reach consensus about work components, sequencing, obstacles, risks, timing and costing. The team should spend more time and effort on the segment at hand rather than the back-end phases. Time and cost estimates must be prepared by the people doing the work and who have done the work before. These professionals have the experience and skills to understand the dependencies and prerequisites, and are motivated to get it right.

Project teams need to realize that they need to get the time and cost estimates approximately right at these interactive planning sessions. Later, the team will be able to provide improved estimates. In conducting these planning sessions, we found that Post-It Notes and flip charts are simple to use and more effective than other complicated methods for developing project plans. It is unfortunate but computer software programs are becoming cumbersome and have little or no impact on the successful delivery of projects! Sophisticated computerized tools based on elaborate detailed work seem to produce schedules and cost estimates that are very expensive to develop and less relevant to reality.

The collaborative nature of this approach makes the team responsible for the planning, not just the project manager or project control personnel, and most importantly, this approach secures the team buy-into the schedule and cost estimates.

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Chapter 6
Expanding the Project Risk Concept

6.1 Operational Risks

Operational risks are threats with a potential impact on project objectives resulting from actions that are controlled by the project manager. Operational risks originate from uncertainties in estimates of time, resources and costs, previously referred to as volatility, and ambiguity as a consequence of missing pieces of information. Typically, identification and handling of operational risks is a major dilemma in planning and controlling the project execution process.

Examples of operational risks are:

- Availability of resources.
- Efficiency.
- Timeliness.
- Operability.
- HSSE.

Availability of resources is necessary to complete project work. The following resources need to be considered:

- Drawings and specifications.
- Materials.
- Engineering work force.
- Construction work force.
- Budget (authorization to spend money).

As materials are supplied by vendors and engineering and construction work is carried out by contractors, risks related to the availability of resources will extend to include an assessment of supplier capabilities and capacity.

Efficiency relates to work procedures including supporting activities such as in- and out-bound logistics, scaffolding and supervision.

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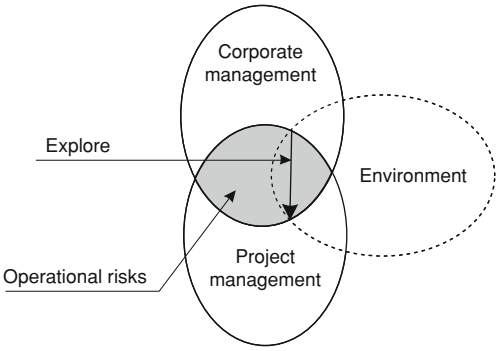

Fig. 6.1 Operational risks

Timeliness refers to risks related to late arrival of drawings and materials, to meeting given milestones for issuing of purchase orders and award of contracts and to delivery of constructed modules and the completion of project work.

Operability refers to the project deliverable (plant); will it work as specified? As a final answer cannot be given prior to production start-up, the focus in the project execution phase is reduced to quality assurance and quality control.

Health, Safety, Security and Environment (HSSE) refers to risks to the project work force, the facility and to relevant project environments.

Operational risks are limited to the impact of conditions that are likely to occur during project execution, i.e. uncertainty related to situations that are expected to happen (volatility). Events of a more extreme nature may occur but are not considered in project cost estimates and schedules. Rather, extremes are explicitly mentioned as a prerequisite for the planning process. Some possible extreme situations may be identified and some may occur during project execution (black swans). Threats related to extreme situations are considered in contextual risk analysis.

The level of project operational risks is related to how aggressive the project objectives and execution strategies are set by corporate management and agreed to by project management. Compared to the traditional model, which implies a linear risk reduction strategy, risk navigation allows for corporate management to set or agree to a greater project risk level than planned for in standard project procedures. This is a risk level that the project management must acknowledge they are able to manage!

Figure 6.1 illustrates operational risks.

6.2 Strategic Risks

Strategic risks are threats with a potential impact on project business objectives resulting from decisions made by corporate management. Decisions made by the project owner organization are typically related to:

- The project lifecycle.
- Maturity at project sanction.
- The project execution strategy.
- Changes to project objectives.
- Acceptance of project business risk exposure.

The project life cycle is related to risks as the number of sequential phases and corresponding decision gates is highly relevant for the project risk exposure. The conventional phase-gated concept is an illustration of one approach to manage project risks through a successive reduction of risks until the risk level is considered acceptable. Decisions at the gates are made by corporate decision boards.

Maturity at project sanction is a major concern for corporate and project management in order to assess the predictability of project outcomes. From a business perspective, time is critical, hence projects may be sanctioned at significantly lower maturity than prescribed in corporate procedures. Most project "wrecks" are claimed to be results of an immature project definition at project sanction.

Project execution strategies may increase the project risk exposure if they are new to the organization. Further, offensive strategies are generally more risky than defensive ones.

Corporate management will, for various reasons, make changes to the agreed project work scope at sanction. Such changes may be required to adapt the project to better fit new and changed business strategies. Increasing the number and volume of changes may jeopardize efficient project work processes, resulting in technical failures, delays and budget overruns.

The risk exposure of the project business case is traditionally assumed to be assessed at the given decision gates leading up to project sanction. At the sanction gate, the project is said to pass the point of no return. Major contracts are being awarded making it financially unattractive to bring the project to a halt as committed costs cannot be recovered (sunk cost theorem).

A vital distinction should be made between:

- The risk taker and
- The risk navigator.

The first is the responsibility of corporate management, the latter the responsibility of the project manager.

It should be noted that, in addition to project owner organizations, suppliers face the same distinction between corporate management and project management. Project risks for a supplier occur when entering into a contract. Strategic risks are borne by the supplier's corporate management and operational risks are borne by the supplier's project manager. All project risks are to be navigated by the project manager.

Figure 6.2 illustrates strategic risks.

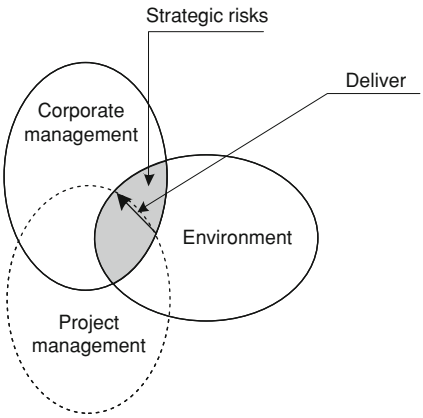

Fig. 6.2 Strategic risks

6.3 Contextual Risks

Contextual risks are threats with a potential impact on business and project objectives imposed by circumstances outside the project and beyond the control of project and corporate management. Such threats may be caused by man or by nature (extremes) and often originate from:

- Project location.
- Business practices.
- Factor market conditions.
- Culture.
- Geopolitics.

Location is the geographical area where the project work is to be executed. Examples of such locations are:

- Euro-hafen, Rotterdam.
- Ultra-deep waters, Gulf of Mexico.
- Sahara Desert, Algeria.
- Alberta, Canada.

Companies that have not operated in, say, Alberta, will have to acquaint themselves with risk factors typical for cold weather locations (e.g. issues related to transportation, weather windows and environmental protection). A completely different set of risk factors will need to be applied to other locations identified in this list.

At most locations there are established business practices typical applicable to a particular industry. A change in a prevailing business practice may be desired to enhance project business value but such a change may introduce risks that the project manager must address.

As projects are seldom executed by the project owner's in-house resources, a number of suppliers are requested to carry out the project work scope. The

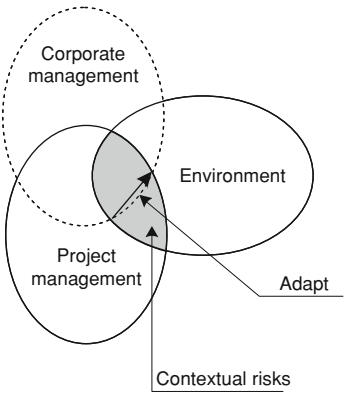

Fig. 6.3 Contextual risks

availability, capability and capacity of suppliers as well as factor market conditions relevant to the project and its location become critical success factors.

International projects often utilize people drawn from different countries representing different cultures. An American company managing a project in China will need to acknowledge that cultural differences must be understood and respected if the project is to run smoothly.

In all regions and countries, governments and a multitude of local interest groups will set requirements and expectations that have to be understood by project and corporate management in order to assess potential project risks. The management team must also address the fact that these requirements and expectations may change over the life of the project. We refer to these risks as geopolitical.

As we did for strategic risks, a vital distinction should be made between:

- The risk taker and
- The risk navigator.

The first is the responsibility of corporate management, the latter the responsibility of the project manager.

Figure 6.3 illustrates contextual risks.

Chapter 7
The Change Process

7.1 Prevailing Best Practices

Over the last decades project owner companies have accumulated comprehensive tacit and explicit knowledge from their execution of major capital projects. The knowledge is captured, analyzed and used to develop project execution models and procedures. The current best practice considers project uncertainties to be "evil"; hence they should be eliminated to control risks. The essence of this mindset is captured in Fig. 7.1.

The figure shows the planning and execution part of the project life cycle. This corresponds to the phases pre-FEED, FEED and execution as described earlier. The figure illustrates that the project execution planning process is driven by ongoing development of the technical concept and development of the business strategy. The objective of *front-end-loading* (pre-FEED and FEED) is to successively reduce the decision space through a number of freeze points referred to as decision gates. To pass the decision gate at project sanction, the technical concept must be sufficiently mature to ensure a manageable level of uncertainty in the execution phase.

Often the project maturity does not fully meet the decision gate criteria, resulting in quality problems, delays and cost increases. As illustrated in the figure, quality is considered superior to time which again is superior to cost, hence lack of maturity often drives increases in project costs.

7.2 Project Execution Models: The Change Process to Shift in Mindset

The prevailing best practice considers projects as deliverables to be executed in stable environments by application of linear deterministic models and tools in a closed system context. We do not consider this best practice to be sufficient for a successful project.

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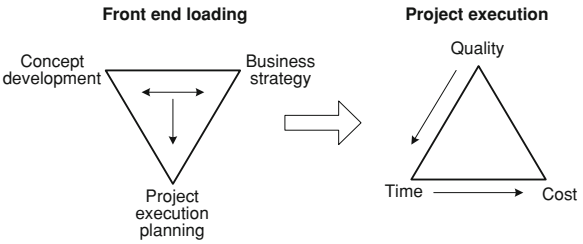

Fig. 7.1 Prevailing best practice

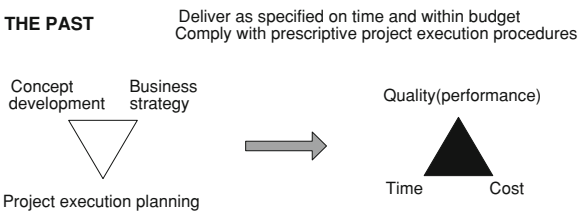

Fig. 7.2 Best practice of the past

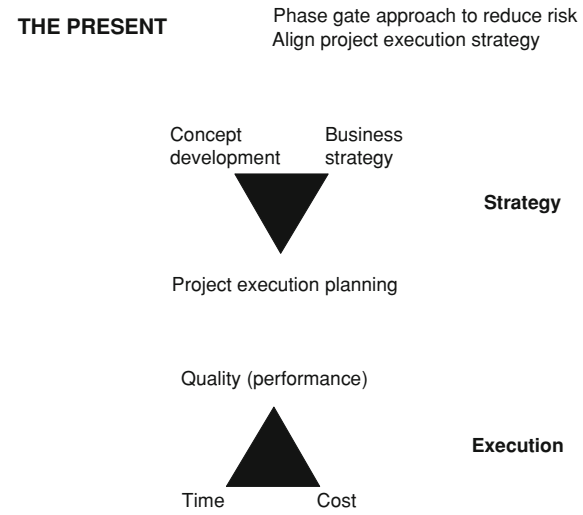

Fig. 7.3 Current best practice

The framework presented in Figs. 7.2, 7.3 and 7.4 outlines the ongoing change in the best practice for major capital projects from the past, through the present and towards the emerging future.

Figure 7.2, the past, indicates that project management is tightly coupled to the "iron triangle" of quality (performance), time and cost, i.e. the focus is on delivering a project that is properly defined and planned. Developments of the concept, the business strategy and the execution plan have all been performed prior to project start. Managing the execution process is reduced to compliance with company procedures that are often prescriptive in nature. The project manager's

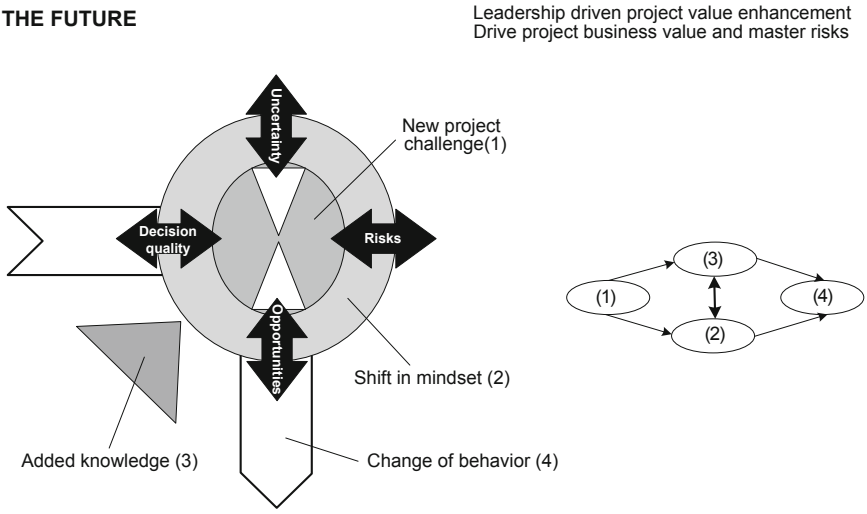

Fig. 7.4 Best practice in the emerging future

"world" is the solid triangle on the right. His or her project charter has been defined to match the business objectives (the rationale for the project). However, project management performance is evaluated at the end of the project by the compliance with quality, time and cost.

The current best practice has remedied this isolated view on the "iron triangle" by focusing more on how the project can meet business objectives. The relationship between the project owner and the project organization is a key point. The owner (as the principal) creates the project strategy and the project organization (as the agent) assesses alternative project execution trajectories.

In Fig. 7.3, the present, "the strategy triangle" (concept development, business strategy and project execution planning) and the "execution triangle" (quality, time and cost) are carried out in parallel, in the sense that the two triangles are heavily interrelated. The work process follows a phase-gated approach, though the project execution team is give considerable freedom to influence the development and implementation of the project strategy over the complete project life cycle.

Prescriptive project execution procedures are, to some extent, replaced by execution guidelines, leaving some freedom for the project execution team to navigate dynamically. The closed system approach of the past is replaced by a semi-open, semi-closed one.

In Fig. 7.4, the future, the two triangles representing the principal and the agent (shown in white) are framed in a wider setting. The wider setting is illustrated by two circles around the two triangles and a number of black two way arrows indicating management focus areas. It demonstrates that the focus is now shifted from aligning strategy and execution in parallel to driving project business value and mastering risk. The management focus areas consequently shift to:

- Decision quality.
- Uncertainty.
- Risks.
- Opportunities.

The inner circle illustrates that we need to prepare ourselves for new project challenges, challenges that might be radically different to what we have seen so far. The outer circle illustrates the need for a shift in mindset, a shift that often is required to take on new competencies and drive a change in behavior.

The figure as a whole may be viewed as a station on a journey. The entry and exit points from the station are indicated by the white arrows in and out of the two circles. At the station, you familiarize yourself with new project challenges and you take on a shift in mindset. You are then open to acquire new knowledge (illustrated by the lower left triangle) that helps you change your behavior to a state that enables you to master new project challenges successfully.

On the right side in the figure, there is an illustration of the process: (1) new and unfamiliar challenges (2) require a shift in mindset (3) to take on new competencies (4) that foster a change of behavior resulting in enhanced project business value.

Mastering new challenges and *added knowledge* refer to new skills that the project management team should acquire and be able to deploy in targeted project situations. This requires a change process that will be explained later (Fig. 7.6). *Shift in mindset* and *change of behavior* primarily relate to the transformation that they have to go through. In order to apply new skills successfully, a shift in mindset and a change of behavior will have to take place at the same time. New skills relate to the *content*, while shift in mindset and change of behavior are *process*-related.

To accommodate critical dependencies between content and process, the general framework is based on a metaphor of a journey that current project managers have to take to become future project leaders. Figure 7.5 illustrates this journey.

The journey (the change process) that the project manager of the past needs to take to become a project leader of the future leads to the successful completion of the journey and helps foster the required shift in mindset that we have argued.

In Fig. 7.5, the one station on the journey (seen in Fig. 7.4) is extended to four stations, each with a different objective. The two triangles representing the owner (principal) and the project organization (agent) form to together a "time-glass". Each triangle may be black or white indicating whether this function is active (black) or idle (white). Also a triangle is added at the lower left hand one corner of each station. This "context" triangle indicates the need for focusing contextual issues during project execution. If this triangle is black, the managing of contextual issues is crucial to project success.

Our journey will take us to these four stations in turn. At each stop the project managers will make a change to a new "train" which symbolizes that a shift in mindset must take place before the manager can learn new skills coupled with the proper project context in which such skills could be applied most successfully.

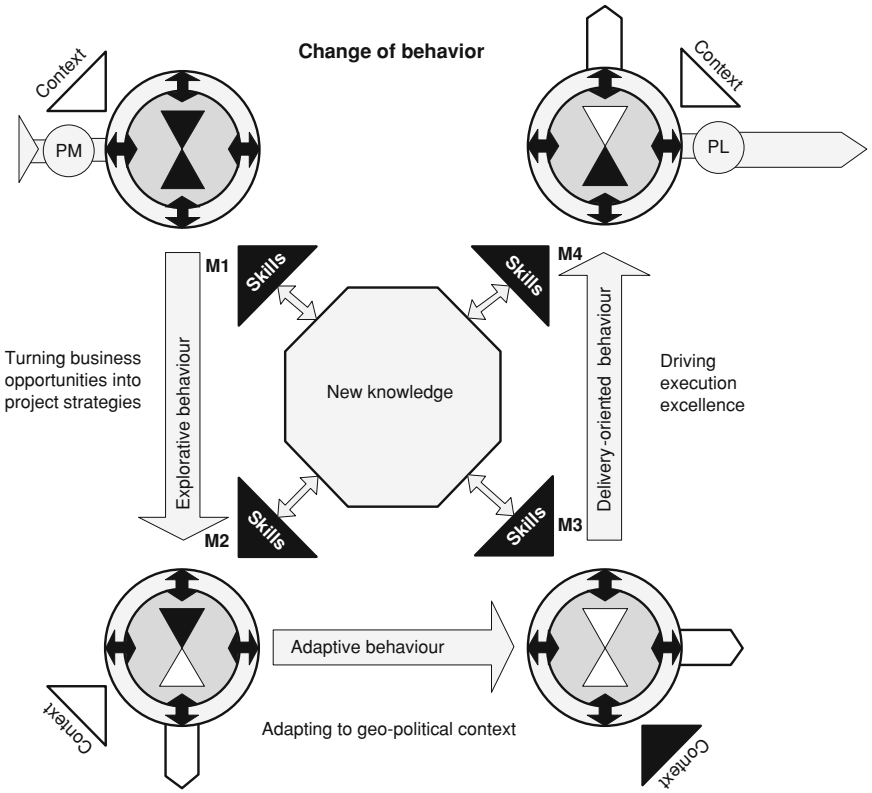

Fig. 7.5 Developing project managers of the past into project leaders for the future

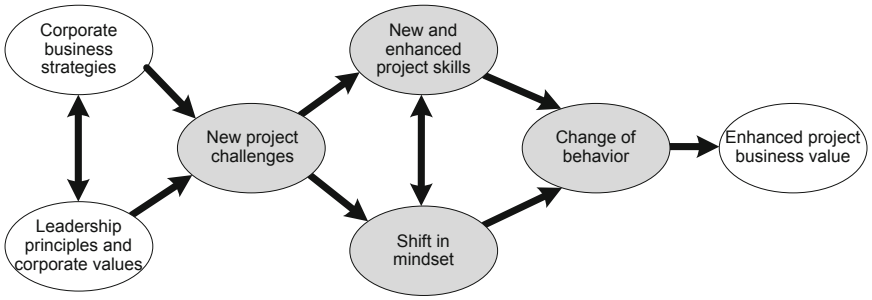

Fig. 7.6 The change process

The objective at the first station, M1, is to provide an overall picture of the kind of project challenges that we are expected to be facing in the foreseeable future and to develop appropriate skills to handle such challenges, as viewed from a business perspective. Both the upper part (the role of the principal) and the lower part (the role of the agent) of the time-glass are black indicating both being active

at this station. Leaving station M1, the project manager is prepared to take on the first leg of the journey; the explorative part.

The objective at the second station, M2, is to prepare for a change of perspective from explorative to adaptive. The project manager is now exposed to new challenges arising from the role of the principal changing from a dynamic "drive change" focus to a passive "adapt to changing environments" focus. Only the upper part of the time-glass is black at this station indicating that the change of perspective is primarily addressed by the project execution strategy which is the responsibility of the principal.

The objective of the third station, M3, is fully to explore the relevant project environments. Here the project manager needs to understand the project challenge from a variety of complementary contexts. The upper part and the lower part of the time-glass is white indicating the focus is on understanding the outer world in which the project has to be performed. The triangle indicating the importance of understanding the context is black. At this station, a change of focus is made from adapting to delivering as promised before the project manager sets off for the third and last leg of the journey.

Finally, at the fourth station, M4, the project delivery is fulfilled and handed over to an operating organization. The project manager (indicated by PM in Fig. 7.5) of the past is transformed into a project leader (indicated by PL) for the future.

The journey is designed as a metaphor for the change process enabling the project leader to master challenges of an explorative, adaptive and delivery-oriented nature that may occur at any time during the project life cycle.

As illustrated in Fig. 7.5 it is suggested that the project manager takes on a three leg journey to fulfill the change required:

- *The explorative journey* will help translate business objectives and corporate strategies into dynamic project execution strategies. Focus is on "driving change", i.e. exploring the business value potential of the project. Application of offensive skills is at the center.
- *The adaptive journey* focuses on how best to navigate in order to exploit opportunities as they emerge, simultaneously seeking to avoid major hindrances that block the project to proceed as planned. Business value is created by means of adaptive skills benefiting from agile maneuvering in turbulent project environments.
- *The delivery-oriented journey* focuses on "deliver as promised", a focal point in the new project leadership principles. Focus is on defensive skills (resilience and robustness) enabling the project to be under control in situations of high uncertainty and exposure to risks.

This journey will prepare the project leaders for the "new world" where they drive project business value while mastering risks. This new world requires a step change from the past practices where focus was on *delivering projects as specified on time and within budget* to *deliver project business value* through application of the new leadership principles while demonstrating passion for the given corporate values.

7.3 The Change Process

The journey to the new world is actually a change process. We have illustrated this in Fig. 7.6. The change process and its relation to corporate business strategies, leadership principles and corporate values are shown.

The suggested change process may be summarized as follows:

- Transforming project managers into project leaders capable of delivering extraordinary project results driven by new leadership principles.
- Changing the focus from viewing projects as well defined deliverables to what the deliverables are meant to deliver—a means to enhance business value.
- Adding new and enhanced skills needed to master new project challenges dynamically.
- Driving a shift in mindset and a change of behavior.

Corporate values and leadership approaches embody the spirit and energy of project owner companies in the "new world". These codes of behavior will guide project leaders through challenges, develop customer orientation and strengthen the corporate business position.

Corporate values relate to leaders being:

- Imaginative.
- Hands-on.
- Professional.
- Truthful.
- Caring.

New leadership principles are suggested that will have to be established as a set of non-negotiable leadership principles based on:

- Personal qualities.

  Commitment.
  Courage.
  Integrity.
  Self-insight.

- Leadership task.

  Deliver results.
  Drive change.
  Develop and energize people.
  Demonstrate passion for corporate values.

- Leadership development.

  Leadership responsibility.
  Teach and learn.
  From own ranks.

The new project leaders are clear about performance standards and individual accountability, and show personal humility.

The corporate values and the new leadership principles represent new project challenges (as shown in Fig. 7.6). These challenges require new skills and a shift in mindset.

In order to master the new project challenges by applying the new leadership principles, the project managers' current inventory of project planning and execution knowledge will have to be expanded in the following directions:

- Leadership behavior.
- Business value.
- Project dynamics.
- Geopolitical context.
- Demand chain constructs and governance.

Chapter 8
Reshaping the Governance System

8.1 Introduction

In this chapter we focus on reshaping the project governance system. Three significant themes are addressed:

- Shifts in mindset.
- The Project Executive Officer.
- The project eco-system.

We start by introducing shifts in mindset that we consider crucial to changing the behavior of the project manager of yesterday to the project leader of tomorrow. Without this change of orientation, the future would simply be a prolongation of the past.

From an organizational perspective, the challenge of managing major capital projects cannot solely be reduced to a manager leading a project team. In the temporary organization established to undertake a major capital project there are many leaders. The leader at the top of the hierarchy of managers in the temporary organization is as accountable for the results of what the organization produces as the CEO of a corporation; hence we have termed the top leader the Project Executive Officer (PEO). Reporting to the PEO are managers accountable for physical parts of the project (sub-project managers) and managers for project functions (functional managers). The sub-project managers may again have managers reporting to them, such as site managers. Managers at the lowest level in the managerial hierarchy typically lead teams of people actually doing project work.

After introducing the many directions of leadership for the PEO we turn to the complete cluster of organizations involved in a major project. The loosely-coupled inter-organizational structure of the temporary organizations established by the

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various companies involved in the project is referred to as a project eco-system. Such a system embraces:

- Clusters of project teams.
- Formal and informal ties that connect the teams.
- The business culture in which they exist.

A selection of the most commonly applied structures is given, focusing on how project risks emerge, are identified and managed and who is best equipped to handle various risks.

8.2 Shifts in Mindset

The project leaders will have to make a shift in mindset to develop their ability to apply the new leadership principles that drive project business value. The focus is expressed as a shift in mindset from viewing:

- Projects as deliverables—to a means to enhance project business value.
- Uncertainties as "evil"—to acknowledging the project nature as being unique and uncertain, hence requiring dynamic strategies and execution philosophies to be mastered successfully.
- Projects as known tasks to be accomplished in known environments—to embracing a continuum of known–unknown tasks to be executed in unfamiliar and often turbulent locations and business environments.
- Deviations from project baselines as inaccurate planning or inappropriate control—to acknowledgement of deviations as being the rule and not the exception, hence applying dynamic skills to drive and deliver extraordinary project business results.

These shifts in mindset foster a change of behavior that may be achieved by means of

- Disrupting the sense of comfort participants have with their status quo, both as leaders and strategic decision makers; creating a belief that the corporation's strategic challenges necessitate a new way of thinking (explorative behavior).
- Providing the tools, techniques, frameworks and mindset to enable participants to meet both emerging business needs and the highest leadership aspirations (adaptive behavior).
- Heightening skills for self-reflection by creating awareness of the participants' leadership behaviors, and accountability for change and personal growth (delivery-oriented behavior).
- Helping participants move along the leadership path and be in the appropriate place for the current context (integrative behavior).

8.3 The Project Executive Officer

A major capital project is carried out by a temporary organization. The size, complexity and financial exposure of a major capital project make such an endeavor similar to the operation of a corporation. The role of the project leader of a complex capital project is hence similar to the role of a CEO of a major company. The focus of the project leader must be directed towards leadership issues of relevance to a CEO of a temporary organization. In order to acknowledge the extensive accountability of a manager for a major capital project, we suggest naming project managers of this kind Project Executive Officers (PEOs).

8.3.1 Toward a New Paradigm for Project Leadership Performance

In this book we take a research-based position on the transition from traditional project management to agile project management. The understanding of this transition is the key focus of tomorrow's project management. This transition is not understood through traditional academic subjects like leadership management, organizational theory, strategy, marketing, etc., but through the integration of these subjects into real project situations. We take an integrated approach where project cases, project tools and actual global situations are as important as the theoretical foundation.

The focus is how the theoretical foundation and the cases, tools and actual situations can help you improve your project leadership performance. The theoretical foundation is mainly built upon leadership and organizational theory, project management, systems theory and future studies (scenario learning), to give an understanding of six essential subjects:

- Project leadership fundamentals.
- Project team composition and development.
- Setting project vision and follow through.
- Seeking corporate commitment.
- Influencing project external stakeholders.
- Project leadership navigation.

The emphasis in terms of leadership, organization and strategy, will be the professional fields of these six subjects integrated into cases, tools and the actual global situations.

The expected results may be summarized in this way:

- To see larger wholes that generate new cross-functional project leadership skills.
- To act in the service of what is emerging so that new insights create new realities (project innovation).
- To communicate across functional project borders.

- To understand the pattern which connect project functions.
- To enhance agility and flexibility by seeing the patterns which integrate whole relationships.
- To shift mindsets through cross-functional project communication.
- To understand theory in the context of practice.

8.3.2 Project Leadership Fundamentals

The starting point is a general outline of a fundamental framework focusing on what people are and how they think and act, i.e. a prerequisite for how people may be influenced. This understanding brings us to the core of contemporary leadership theories. The leader is put in a position of influence in the center of a group of people including subordinates, peers, and superiors. This traditional 360° perspective of a corporate middle manager [7] is then extended to what we refer to as the 720° perspective of the PEO. The PEO has to complement intra-organizational leadership challenges with inter-organizational and extra-organizational concerns.

A differentiation of leadership roles has to be introduced, triggered by the books the Leadership Pipeline Concept [2] and Good to Great [3]. In particular, the distinction so vital to projects between general and functional managers should be highlighted. Core themes are:

- People are different.
- How people think and act.
- How people are influenced.
- Contemporary leadership theories.
- Leading temporary organizations.
- Leadership style.

8.3.3 Project Team Composition and Development

Later in this chapter we will give an outline of the complete project eco-system, highlighting the various actors, their interests and ways of interacting that will influence project trajectories. In particular, focus is directed towards teams as clusters of individuals as the building blocks of the eco-system. In projects, teams are formed, brought to function for a given period of time, and then disbanded. The importance of getting the right people on the team is vital, similarly how to get the wrong people off the team [3]. Contemporary theories on management teams are drawn from and modified to the context of projects and a vital distinction is made between project executive teams and project functional teams. Communication within and between

teams in the project eco-system is crucial to achieving extraordinary project performance and should be dealt with comprehensively. Core themes are:

- Inter-organizational project structures.
- Getting the right people on the team and the wrong people off.
- Contemporary team development theories.
- Building team coherence and trust.
- Extraordinary team performance.
- Project executive teams.
- Project functional teams.
- Team closure.

8.3.4 Selecting the Project Vision and Follow Through

We focus on how project visions and strategies are formed and implemented. The point of departure is that projects are different, hence in need of different strategies. The project leader must comply with differences in corporate strategies and leadership principles. The project context, its objectives and execution strategies, should be questioned to test their relevance based on the overall vision of the corporation. The focus is to identify relevant project risks along three different but complementary dimensions: contextual risks, strategic risks and operational risks. Core themes for selecting project vision are:

- Scenario planning.
- Corporate strategies and leadership principles.
- Project specificity.
- Project context and its relevance.
- Project objectives and their relevance.
- Project execution strategies and their relevance.
- Setting performance goals.
- Selecting performance metrics.
- Managing contextual risks.
- Managing strategic risks.
- Managing operational risks.
- Performance volatility and compensation.

8.3.5 Seeking Corporate Commitment

We now return to the 360° perspective and ask "how to manage your boss and your boss' boss". As projects often are executed under a high degree of uncertainty

and under turbulent project environments, the project leader will frequently have to interact with the corporate management team. The purpose of these interactions is to seek corporate support for changes to objectives and strategies, to inform management about deviations from plans that may jeopardize the chosen project trajectory and to seek resolution of corporate level issues. To be able to master such a task, the project leader will have to strengthen his or her capabilities to communicate and influence—"to lead without authority". The core themes are:

- Leading without authority.
- 360° leadership.
- Delegation of authority.
- Compliance management.
- How to manage your boss.
- The management/leadership dichotomy.

8.3.6 Influencing Project External Stakeholders

We now extend the 360° perspective to a 720° perspective. We view the project leader as a PEO who also has to deal with stakeholders external to the corporation. External stakeholders can be vendors and contractors, regional and national authorities as well as media and special interest groups. As projects often catch the interest of media in situations such as accidents, delays and major budget overruns, the corporation's reputation is at risk. Therefore, the project leader has to be capable of managing a variety of situations requiring an ability to bounce back from major shocks (resilience), to swiftly adapt to new situations by sidestepping upcoming threats and harvesting emerging opportunities (agility) and to drive change as appropriate to enhance project business value.

As stakeholders in the outside world view projects based on their own mindsets, the project trajectory may be perceived negatively in situations where it is positive, triggering actions that may hurt project performance. Therefore it is a particular challenge for the project leader to keep relevant stakeholders informed through feed forward and feedback communication processes. Again the project leader has to demonstrate abilities to lead without power and to influence stakeholders that often have different interests that conflict with those of the project owner organization. Core themes are:

- Building project external relationships.
- Resilience.
- Agility.
- Versatility (deploy wide repertoire of skills within project boundaries).
- Malleability (reshape/mold project boundaries).

- Project external communication.
- Leading project external stakeholders.

8.3.7 Project Leadership Navigation

We have outlined a number of perspectives on project leadership. We now move to a holistic view. The project leader should take on a business perspective that goes beyond influencing people to meet a set target under known circumstances. Project leaders have many responsibilities: to set the project vision and follow through, to form a project executive team and build an inter-organizational project structure, to lead their corporate management team and external stakeholders without authority and, in a highly uncertain world, they also have to navigate dynamically and meet the business objectives of the project. Core themes are:

- Project business value—the project owner's perspective.
- Project business value—the suppliers' perspective.
- Project specific risks.
- Relevant corporate risks.
- The project production focus—reducing capital expenditures.
- The project implementation focus—enhancing project life cycle profit.
- The project business value focus—enhancing project net present worth.
- Integrated project operations.
- Integrated project leadership.

8.3.8 The Management Role of the PEO

The PEO, representing senior management, has a crucial leadership role in creating an environment where the sub-project managers and teams can succeed. PEOs as leaders must embody a mix of personal humility and professional will. They must be fanatically driven and infected with an incurable need to produce sustained results. They must be resolved to do whatever it takes to make the company great, no matter how big or hard the decision. Leaders attribute success to factors other than themselves, exhibit a compelling modesty, are self-effecting and understated. When things go poorly, however, they blame themselves, taking full responsibility [3].

The most important role for the PEO and senior management is recruiting the right people to the team and removing the wrong people from the team. The right people will determine *what*, *how* and *when* to deliver the project. Our observations concur with Collins [3] that the *who* question comes before the *what* decisions, i.e., before vision, before strategy, before organization structure and before tactics. Who is leading the team and who is on the team are critical steps toward success.

Providing the right leadership is absolutely critical to the successful application of this new thinking in the delivery of major capital projects. This includes addressing contextual and strategic risks and being willing to make timely decisions under uncertainty. The PEO takes responsibility as the spokesperson of senior management and works directly with the sub-project managers to hold the project teams and contractors responsible for achieving the outcomes as promised at sanction. The PEO:

- Possesses the skills and experience needed to manage the owner's role in the project.
- Maintains direct access to the people making key decisions.
- Is vested with authority to take day-to-day executive action.
- Sees the project through to completion.

The PEO must be prepared to take action in the face of unforeseen events and to deal with issues that are the responsibility of the owner with vigor and effectiveness. The PEO will occasionally require professional advice and encourage timely decisions regarding [4]:

- *Strategy for project design and construction including risk allocation and contracting strategies—what risk is the client willing and able to bear?*
- *Strategy for project monitoring and proactive approach to avoid/minimize claims and disputes.*
- *Strategy for teamwork.*
- *Appraising the options, cost comparisons, benefits and risks of value improving practice techniques that would add significant value.*

One of the important roles of the PEO is to select the right sub-project managers and other the key players. The right people do not need to be tightly managed; they will be self-motivated by their inner drive to produce the best results and to be part of creating something great [3]. A reversal in thinking is required by the PEO for selecting the right people. The PEO needs to move away from hiring contract staff to hiring salaried staff for important positions and to insure that adaptive critical competencies are acquired.

The PEO and the sub-project managers must create a working environment in which the teams can easily adapt to a changing world and emerging risks. This means developing the right plans and schedules in collaboration with the owner's team. The owner develops the need and scope and the project teams distribute tasks as they work and measure progress for each segment and adjust plans with the owner as necessary.

It is time to free project managers from being simple taskmasters thereby enabling them to focus on being leaders who keep the spotlight on the project vision and corporate intent, who inspire their teams, who promote teamwork and collaboration, who champion the project and who remove obstacles to progress. Rather than being operational controllers, project managers can become adaptive leaders by relinquishing their reliance on old style management.

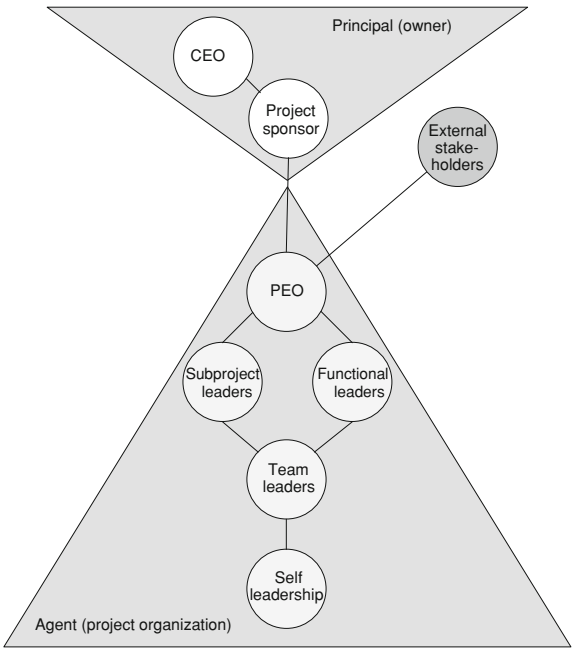

Fig. 8.1 Leadership structure of a temporary organization for a major capital project

The various roles of the PEO and other managers in a temporary organization designed to undertake a major capital project are illustrated in Fig. 8.1.

8.4 The Project Eco-System

Most textbooks on project management describe organizing, planning and controlling as activities that are the responsibility of a project team within a temporary organization. The issues raised are typically of an intra-organizational nature. Though purchasing of material and contracting of services may be addressed, such activities are considered external to the project and the project team.

Some textbooks raise important issues related to contracts, however, the context is dyadic, i.e., the focus is on a single contract considered isolated from other contract agreements on the same project. As most major capital projects embrace a number of key players we need to extend our view from single contractual relationships to a comprehensive holistic view of the project. We extend the dyadic perspective to a polyadic perspective, i.e., we design a model comprising the 5–10 most important players and their internal dynamics. This is the only way we can provide an adequate context for understanding how project risks emerge, for how to identify them and who should be assigned the role to manage the various categories of risks that might occur.

As we have discussed earlier, project owners have a need to design and build a facility of some type to fulfill a business strategy. As project owners are not in the

business of engineering and construction, they look to suppliers who are in the business of offering such services. Alternative sourcing strategies may be available to the project owners.

The execution of a major capital project that is based on external sourcing will thus comprise a structure of contracted suppliers. The complete structure of the project owner and contracted suppliers is referred to as the *project eco-system* [1]. The project eco-system is a network-like construct with semi-autonomous nodes referred to as *clusters* (supplier intra-organizational project teams).

The ties between the clusters are referred to as *connectivities,* constituting formal relationships (contracts), informal relationships (mutual respect and trust), workflow related dependencies (delivery of material specifications, equipment lists, drawings, materials, equipment, modules and miscellaneous services), information exchange and inter-organizational consultation.

The project eco-system operates in a project environment referred to as *cohesion* (industry practices, industry norms and standards, rules and regulations). External forces that act on the project eco-system are project sponsors (from both owner and supplier organizations), unions, competitors, regulatory and governmental authorities, special interest groups and many others.

When we consider uncertainty and risk in a project, the complete project eco-system must be taken into account. No doubt risks can arise from a single contractual relationship but risks also arise from the interactions among the contractors and between the owner and the contractors. Operational risks are often connected to a single contract or relationship. Strategic and contextual risks may arise from the complete project eco-system. Therefore it becomes crucial to understand how the project eco-system works and to find appropriate strategies for designing this project eco-system.

In this section we will first discuss project risk connected with sourcing strategies in general, both from the owner's and from the supplier's perspective. Then we will discuss risk connected with contracting strategies from two different perspectives: horizontal and vertical dependences. Finally we will discuss alternate project eco-systems.

8.4.1 Sourcing Strategies: The Owner's Perspective

Analysis of a company's purchasing expenditures [6] indicates that the "20–80 rule" applies, 20% of purchased materials and services account for 80% of the purchasing turnover. The remaining 80% of purchased items often relate to a huge number of small expense items and small suppliers. This is the first step in identifying the company's strategic commodities and suppliers. This same step is applicable to suppliers and sub-suppliers.

The next step is to identify the strategic importance of the supply and the power balance between the owner and the supplier. To do this we need to assign project procurement to distinct market segments.

A frequently applied concept for strategic market segmentation in procurement is referred to as the Kraljic matrix [5]. Kraljic differentiates between the following segments:

- *Routine products.*
- *Leverage products.*
- *Bottleneck products.*
- *Strategic products.*

Routine products usually have a small value per item and there are many alternate suppliers. This group of products is often considered expensive to handle compared to the value of the procured item, hence 80% of purchasing efforts are allocated to handle 20% of the total purchasing expenditures [6].

According to van Weele [6] the suggested strategy for clients procuring *routine products* is to reduce transaction costs through:

- Reducing the number of suppliers.
- Using e-auctions and e-procurement solutions.

Leverage products are products that may be obtained from various suppliers at standard quality grades. Often they represent a significant share of the total project procurement costs. As a small change in price may have a substantial effect on cost, the project owner often exerts aggressive tendering action among a small sample of prequalified suppliers. The suggested strategy for owners procuring *leverage products* is *competitive bidding* [6].

Bottleneck products are products that can be obtained from one supplier only. Generally the supplier has a dominant position in the market making the buyer vulnerable to high prices, long delivery times and inappropriate service. Leverage products (e.g. facility process equipment) once procured may become a bottleneck product as spare parts required for the operation of the facility often are specific for the type of equipment procured. The suggested owner strategy for procuring *bottleneck products* is to secure the supply from the sole supplier while simultaneously searching for alternate suppliers [6].

Strategic products are high-tech, high-volume products, which are often supplied to customer specifications. Only one source of supply is available and it cannot be changed in the near term without incurring considerable cost. Interactions between buyer and supplier are usually intensive. Depending on the balance of power between the buyer and the supplier, three sub-segments are identified:

- Buyer-dominated segment.
- Supplier-dominated segment.
- Balanced relationship.

In a buyer-dominated segment, the project owner imposes his own requirements on the supplier, while in a supplier-dominated segment, the project owner is "locked-in" to the technology of the supplier. Examples of the latter are Microsoft, SAP and similar products where customers can only accept the conditions that the supplier imposes. *Strategic products* are critical for the project cost but the buyer is

dependent on the supplier. The suggested strategy for procuring *strategic products* is performance based partnerships [6].

8.4.2 Sourcing Strategies: The Supplier's Perspective

In designing its overall business strategy, a supplier will have to make explicit decisions about how she positions herself vis-à-vis three major stakeholders:

- Customers.
- Competitors.
- Sub-suppliers.

The supplier's mission and strategy will determine whether to:

- Market its services to a target group of customers—embracing current and future clients.
- Benchmark its efficiency against competitors operating in the specific market segment.
- Outsource or sub-contract services to sub-suppliers as appropriate to sustain competitiveness in the marketplace [6].

Suppliers must not only be able to respond to customers' needs, they need to respond in such a way that they achieve a distinct sustainable competitive advantage. According to van Weele [6] this may explain why customers are turning to a particular supplier instead of its competitors. A competitive advantage may be derived from a superior:

- Cost position.
- Brand image.
- Product quality.
- Logistics system.
- Customer service.

The ultimate competitive position of a supplier may then be considered a result of [6]:

- Its position relative to its major customers.
- Its sustainable, distinct advantage compared with direct and indirect competitors.
- Its positioning versus its major sub-suppliers and its supply chain strategies.

8.4.3 Horizontal Dependencies in Contract Strategies

The project owner may choose among three significantly different concepts for contracting services:

- Turnkey contractor.
- General contractor.
- Multiple prime contractors.

In the following we will explore the horizontal and vertical relationships in these structures to better understand the kind of project risks they can create.

Independent of the contracting strategy, a chosen number of interdependent services must be undertaken in a major capital project. For the purpose of this discussion, a differentiation between the following services is useful:

- *Engineering services.*
- *Fabrication services.*
- *Miscellaneous services.*
- *Installation services.*
- *Delivery of critical materials.*
- *Delivery of non-critical materials.*

Engineering services are related to design, drawings and material take-offs including equipment lists (i.e. the quantification and specification of materials needed for construction). For a turnkey contractor, engineering services are an integral part of the contract and are typically carried out by the turnkey contractor himself, or engineering work may be out-sourced or sub-contracted wholly or in part to 2nd tier suppliers of engineering services. If the general contractor or the multiple prime contractors are chosen, engineering services are awarded on separate contracts to 1st tier suppliers.

There are a number of administrative support services needed for the execution phase of the project. Of particular interest are working processes related to the preparation of tender documents, the administration of the tendering process, the purchasing and expediting of procurement orders as well as logistics and insurance. Such support services may in whole or in part be carried out by the project owner, the engineering contractor (EC) or be awarded to a separate *managing contractor* on an own contract among the 1st tier contractors. In particular for multiple prime contractors, the need for a managing contractor emerges as the number of prime contractors increase.

For simplicity reasons, engineering services, which may or may not include administrative support services, will be represented as the *EC* node in the project eco-system discussion that follows.

Fabrication services refer to construction work that is taking place at the fabrication contractor's own yard. Typically fabrication services consist of construction of structural components and fabrication and outfitting of modules that later will be installed as vital parts of the facility under construction at the project owner's site.

In the turnkey and general contractor concept, fabrication is an integral part of the contract and carried out by the contractor himself, or fabrication work wholly or in part be out-sourced or sub-contracted to 2nd tier suppliers of fabrication services. If the multiple prime contractor concept is chosen, fabrication services are awarded on separate contracts to 1st tier suppliers.

For simplicity reasons, fabrication services will be represented as the *fabrication contractor* (*FC*) node in the project eco-system discussion that follows.

Installation services relate to all work at the construction site or sites of the project owner including fabrication activities that take place on site.

As for fabrication services, installation services are an integral part of the contract and are carried out by the contractor himself or may wholly or in part be out-sourced or sub-contracted to 2nd tier suppliers of installation services. If the multiple prime contractor concept is chosen, installation services are awarded on separate contracts to 1st tier suppliers.

For simplicity reasons, installation services (construction work at the owner's site or sites) will be represented as the *installation contractor* (*IC*) node in the project eco-system discussion that follows.

Miscellaneous services (*MS*) relate to all other direct and indirect construction or construction support at the owner's construction site. For simplicity reasons, these MS will be represented as the *MS* node in the project eco-system discussion that follows. It should be noted that the suppliers of MS at a major construction site could be extensive in number and varied in terms of services provided. In short, we are not likely to find one supplier in charge of all MS at an owner's construction site.

For clarity reasons, we use the term *contractor* for suppliers that provide direct and indirect services. Suppliers of material are referred to as *vendors*. We refer to *purchasing* when we address the activities related to vendors while we refer to *contracting* when we address the activities related to contractors. The term *supplier* then refers to a contractor or a vendor, while *procurement* refers to contracting or purchasing.

As some materials are critical to the project and others are not, we suggest a distinction be made to single out the *critical deliverables* from the *non-critical deliverables*. Traditionally, critical deliverables are often linked to the delivery of non-standard equipment or equipment with a long lead time from order to receipt. Typically such types of equipment were thought of as compressors and non-standard pumps and valves. Tight markets may, however, make even standard equipment and material become critical. For simplicity we suggest critical deliverables to be limited to the "critical few" and use non-standard equipment as an archetype of such a delivery. All other deliverables will then be referred to as the "trivial many".

The various services and deliverables of materials are represented by nodes in Fig. 8.2. The figure illustrates major work flow related interactions between the nodes. In our project eco-system, the "critical few" deliverables are denoted by the node *vendor of critical materials* (*CV*) and the "trivial many" deliverables by *vendor of non-critical materials* (*NV*).

Again, it should be noted that the number of vendors of critical and particular non-critical materials could be extensive and varied.

The main ties between the organizational units in the project eco-system relate to:

- Material take offs.
- Vendor information.

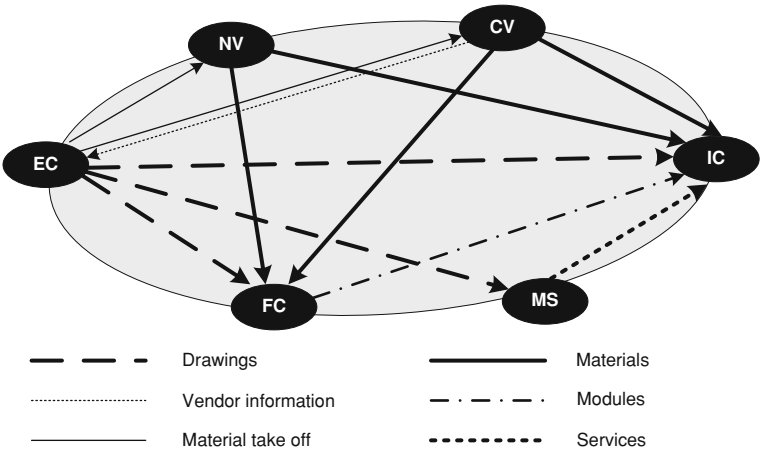

Fig. 8.2 Horizontal dependencies

- Drawings.
- Delivery of materials.
- Delivery of modules.
- Delivery of construction services.

Material take offs represent a listing and quantification of equipment and other materials to be purchased. Material take offs are needed for the purchasing process to commence. Quantities ordered may, however, change as the engineering process proceeds.

Purchasing of non-standard equipment often implies that the vendor is asked to customize a certain type of equipment to fit given technical project requirements. The vendor will then take on detailed engineering work for the required modifications to the standard deliverables of the vendor. In short this means that the EC will have to wait for the details of the customized equipment drawings before issuing affected construction drawings. This feedback, often of vital information to construction work, is referred to as *vendor information*. If vendor information is delivered late, the EC may have to issue *drawings for construction* (*IFC drawings*) with blanked out areas, often noted as holds pending vendor information. Late vendor information can significantly jeopardize the construction process.

As indicated in Fig. 8.2 the other work flows are related to delivery of materials to fabrication and installation sites, to modules and to construction services at the installation sites.

The purpose of Fig. 8.2 is to illustrate the main work flow related dependencies between complementary functions for a project in the execution phase and how risks related to such ties may emerge. Depending on the contracting strategy chosen and to the extent a particular supplier chooses to use sub-suppliers, these functions may wholly or in part be carried out under the same contract. As a result,

the arrows representing the work flow related ties may not strictly be represented as horizontal dependencies only.

8.4.4 Vertical Dependencies in Contract Strategies

The dependencies described in the previous section are horizontal and constitute a supply chain perspective referred to as a *chain of contracts*. The arrows in Fig. 8.2 illustrate that such a chain is dominated by a *timeline*. For projects this timeline is of a one-of-a-kind nature, i.e. it is not designed to be repeated on the same project.

Further, we stressed that horizontal ties are work flow related. In the case of a general contractor strategy, the EC can neither exert formal governance over the construction contractor nor can the construction contractor exert formal governance over the EC. All exertion of governance relates to vertical dependencies. The project owner exerts governance over both the EC and the general contractor. The general contractor exerts governance over his sub-suppliers. The direction and power of governance follows the conditions agreed to in the contract documents. The selection of a contracting strategy hence influences the structure of vertical dependencies thus constituting a formal structure for how project risks can be managed and by whom.

As many suppliers rely on sub-suppliers, vertical dependencies often complement the horizontal dependencies to accommodate for work flow related ties. In this case, work flow related ties follow the direction of the contractual relationship, which is vertical.

Vertical dependencies between contracts on a project are referred to as a *hierarchy of contracts*. A hierarchy of contracts covering two tiers of suppliers on a project is illustrated in Fig. 8.3.

8.4.5 Alternate Project Eco-Systems

We now turn to the integration of horizontal and vertical dependencies and look at ties related both to the work flow of project work and contractual contingent governance in the project execution phase. We will explain four different concepts:

- *The turnkey concept.*
- *The general contractor concept.*
- *The multiple prime concept.*
- *The ad hoc alliance concept.*

In the *turnkey concept,* the project owner exerts governance over the turnkey contractor through the formal administrative communication link established between the appointed company representatives for the contracting parties, as stated in the contract documents.

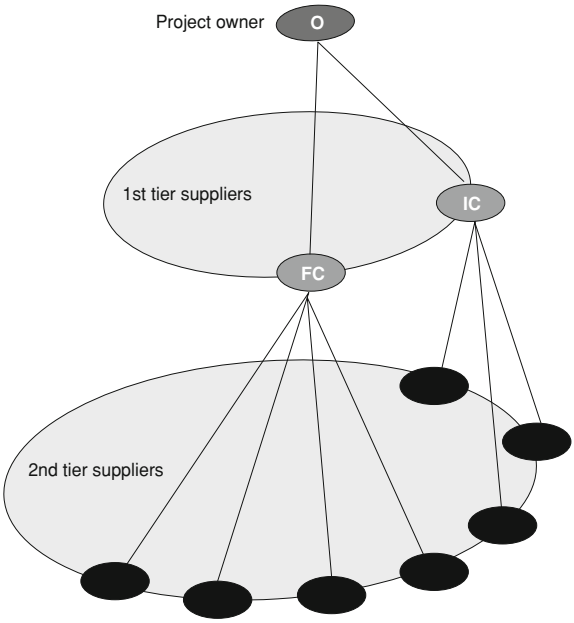

Fig. 8.3 Vertical dependencies

The project management team of the turnkey contractor will then exert governance over contractor internal units and or sub-suppliers. In the case of sub-suppliers, the governance will follow the contractually established links between the company representatives for the turnkey contractor and the sub-suppliers. In the case of contractor internal units, governance will be exerted through the company internal hierarchy established for the contracted work to be carried out by the units concerned.

The vertical and the horizontal dependencies for the turnkey concept are illustrated in Fig. 8.4.

As illustrated by Fig. 8.4, there are no formal links between the owner organization and the sub-suppliers carrying out project work. The project owner has generally limited insight into the key contractor's working processes and day to day communication between the parties is minimal. Problems that arise at the turnkey contractor's work sites are often considered company internal matters and are not reported to the project owner. If such problems cannot be resolved by the turnkey contractor, a delay in the contracted project completion date will occur. Potential problems, often reported late or kept hidden from the project owner, may result in substantial delays. Lack of continuous information of progress on key contractor's work may therefore cause major problems to the project owner. Late reception of potential problems may jeopardize the project owner's ability to intervene and implement corrective measures.

In the *general contractor concept,* the project owner exerts governance over the EC and the general contractor through separate contracts. There are no formal contractual ties between the two contractors. All work related interfaces between

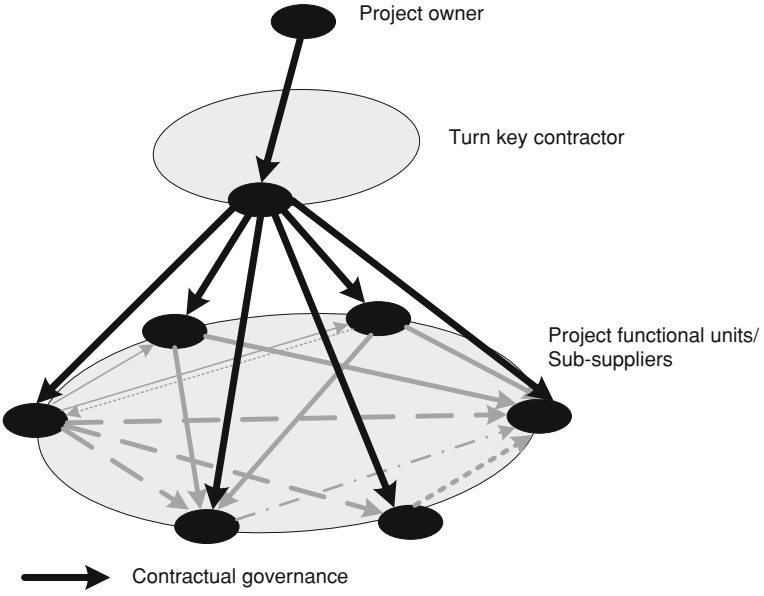

Fig. 8.4 Vertical and horizontal ties in a turnkey concept

the two contractors have to be managed by the project owner. Governance over the contracted parties is exerted through appointed owner representatives.

The project management teams of the EC and the general contractor will then exert governance over their respective contractor internal units and or sub-suppliers. In the case of sub-suppliers, the governance will follow the contractually established links between the company representatives appointed by the suppliers. In the case of contractor internal units, governance will be exerted through the company internal hierarchies established for the contracted work to be carried out by the units concerned.

As for the turnkey concept, the project owner has limited knowledge about the general contractor's internal working processes which may cause the same kind of concerns as mentioned for the turnkey concept. In his day to day management of work flow related dependencies between the EC and the general contractor, the project owner is in a more favorable situation than in the case of the turnkey concept. Information about potential delays in delivery of up to date drawings and corrective actions could momentarily be enforced through lines established for formal governance between the project owner and the two 1st tier suppliers in the project triad.

The vertical and the horizontal dependencies for the general contractor concept are illustrated in Fig. 8.5.

In the *multiple prime concept,* the project owner exerts governance over all 1st tier suppliers through separate contracts. There are no formal contractual ties between the 1st tier suppliers. All work related interfaces between the suppliers

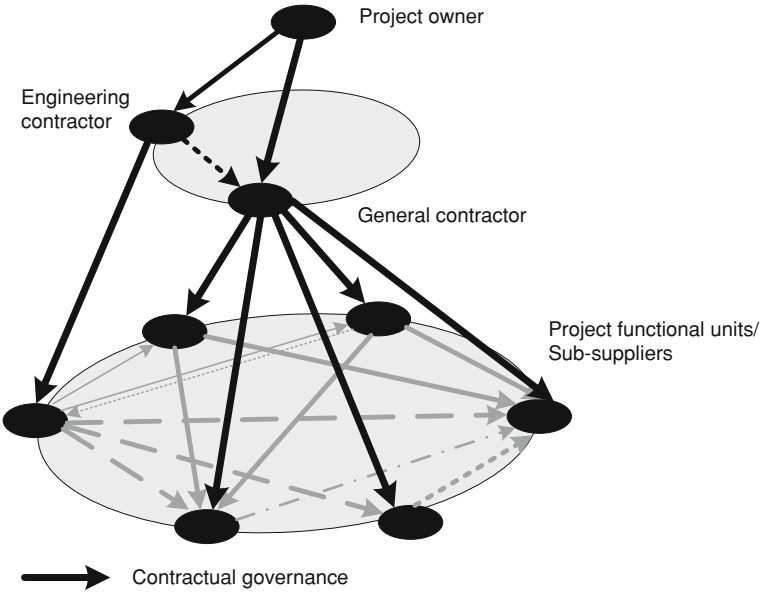

Fig. 8.5 Vertical and horizontal ties in a general contractor concept

have to be managed by the project owner and governance over the contracted parties is exerted through the appointed representatives.

The project management teams of the 1st tier suppliers will exert governance over their respective contractor internal units and sub-suppliers. In the case of sub-suppliers, the governance will follow the contractually established links between the company representatives appointed by the suppliers. In the case of contractor internal units, governance will be exerted through the company internal hierarchies established for the contracted work to be carried out by the units concerned.

As the number of 1st tier suppliers increases from two in the general contractor concept to, say 5–8 in the multiple prime concept, the workload for managing contractual interfaces becomes extensive as the project owner has to take on managerial work processes previously undertaken by the 1st tier suppliers themselves, either through contractual relationships to sub-suppliers or by supplier internal hierarchies.

On the one hand, the project owner gets a better understanding on how the project supply chain is being managed as he becomes deeply involved in the day to day management of project work. Progress information should be accurate and remedial actions could be enforced with minimal delay. This process could, however, be slowed considerably if the 1st tier supplier uses a significant number of sub-suppliers. The additional amount of managerial work for the project owner could substantiate the need for a professional management contractor. The management contractor often acts on behalf of the project owner but has no formal

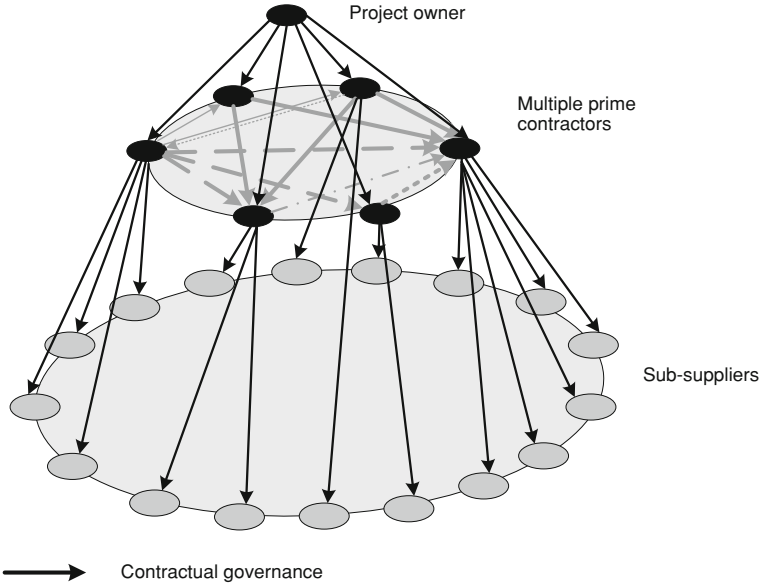

Fig. 8.6 Vertical and horizontal ties in a multiple primes concept

responsibility for contracted work and cannot enforce any governance over the suppliers without the consent of the project owner.

The vertical and the horizontal dependencies for the multiple prime concept are illustrated in Fig. 8.6.

In the *ad hoc alliance concept,* we distinguish between forced and voluntary alliances. In a *forced alliance,* the project owner selects the suppliers and groups them into a formal collaborating unit for the life of the project. In a *voluntary alliance,* a group of suppliers offering complementary services themselves form and organize a formal collaborating unit. In both alliances, two sets of contractual relationships are needed, one horizontal and one vertical. For example, the multiple prime concept extended with a managing contractor could be developed into a forced or voluntary ad hoc project supplier alliance.

The horizontal relationship consists of an inter-supplier contract of the supplier alliance parties that make them collectively accountable for work contracted to the alliance. The contractual conditions will, among other things, include an agreement of how work will be divided between the suppliers, contractual liabilities, gain-sharing mechanisms and procedures for resolution of conflicts.

The vertical relationship consists of a supplier alliance contract with the project owner. In order to work efficiently and effectively, the alliance needs to be represented by a management team with authority to handle contractual matters with the project owner without having to negotiate with the individual alliance partners. The supplier alliance management team is thereby authorized to exert governance over the suppliers in the alliance group.

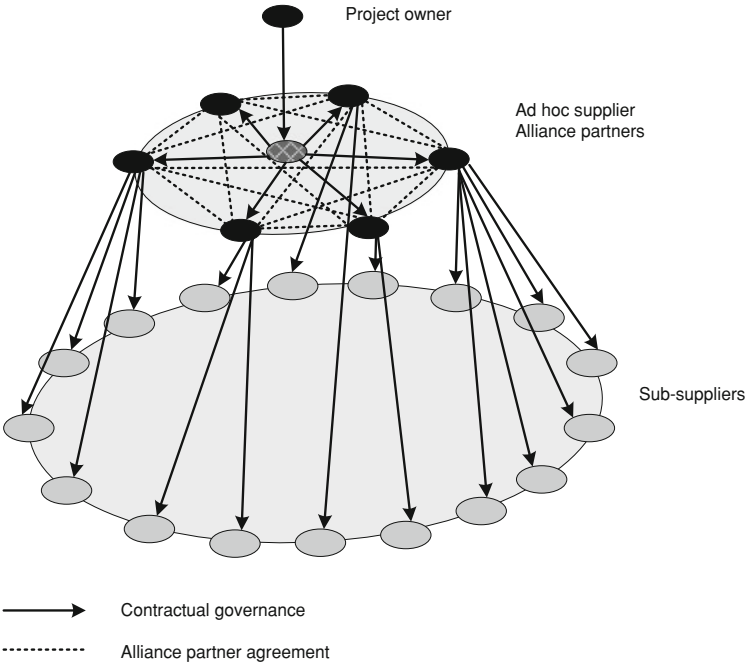

Fig. 8.7 Vertical and horizontal ties in an ad hoc alliance concept

The vertical and the horizontal dependencies for an ad hoc project supplier alliance are illustrated in Fig. 8.7.

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Chapter 9
Improving the Decision Process

9.1 Introduction

The quest for predictability of major capital project outcomes has been long and largely frustrating. Over the past 20 years, leading owner organizations have invested significant levels of effort to implement work processes to improve the front-end definition of their projects. Clearly, this has improved the accuracy of project plans, cost estimates, and decisions. Equally clearly, it has not been enough, as many of these same organizations now question why they still experience massive cost overruns and delays on their most critical projects.

The idea driving the implementation of phased and gated processes for front-end loading is that predictability is improved by better decision-making at each gate. That is still true today; in fact, given the exponential growth in project size, complexity and risk it is even more so. The challenge today is to determine what must be done to further improve the decision process.

Leading owner organizations today are finding that a more holistic approach that integrates the four planes of capital projects: Commercial, Financial, Technical, and Execution, provides a considerable improvement in their ability to recognize the aggregate exposure from project risks. The discipline, fact-finding, and unbiased perspectives associated with due diligence for Merger and Acquisition (M&A) investments are equally important for CAPEX investments. A structured approach to capital project due diligence provides owners, investors, and lenders with the assurance that all project risks have been identified and analyzed before critical decisions are to be made.

In this chapter we will explain the process of plan and goals, and then introduce two aspects to help understand the risk picture in the decision process. These two aspects are referred to as *due diligence* and *bankability*.

A. Rolstadås et al., *Risk Navigation Strategies for Major Capital Projects*,
Springer Series in Reliability Engineering, DOI: 10.1007/978-0-85729-594-1_9,

9.2 Objectives

9.2.1 The Predictability Predicament

The more critical the project, the more important is its predictability. Of course, the most important projects in the company's CAPEX portfolio tend to be those that carry the most risk, due to their large size and complexity. Cost overruns and schedule delays on these mega-projects cannot easily be offset by better-than-expected performance on other (smaller) projects, so the expectations for predictability are even higher. The predicament is that predictability on these projects is much harder to achieve since they impact and are impacted by the environment in which they take place.

Who owns predictability? Every decision-maker seeks predictability in the outcome of his or her capital project investments. Management generally looks to others to be responsible for predictable project outcomes, such as their project managers and teams, or the engineering and construction contractors those teams entrust with the work. Few decision-makers see *themselves* as the primary drivers of predictable outcomes, perhaps they should. The decisions, strategies and plans that shape, drive and deliver a capital project are, above all else, the primary determinants of predictability and drivers of success.

9.2.2 Capital Project Decisions Must Consider the Entire Business Model

In general, the goal of a CAPEX investment is to maintain or increase future free cash-flow. In addition to paying dividends and possibly buying back company stock, free cash-flow is used to invest in sources of future cash-flow, i.e., mergers and acquisitions (M&A) and capital projects (i.e., revenue-producing facilities). This is illustrated by Fig. 9.1.

This broad business goal is eventually translated into capital projects whose strategies, plans and decisions are defined on four planes:

- *The Commercial Plane*—describes how the capital project will produce revenue via agreements with suppliers, off-takers, et al.
- *The Financial Plane*—describes how the project's capital investment will be paid for via arrangements with partners, lenders, et al.
- *The Technical Plane*—describes the technology to be used to create the facilities required to produce the expected revenue and the physical scope of those facilities.
- *The Execution Plane*—describes (inter alia) the organization and contracting strategies for performing the engineering, procurement, construction, installation and startup and the plans for managing those activities.

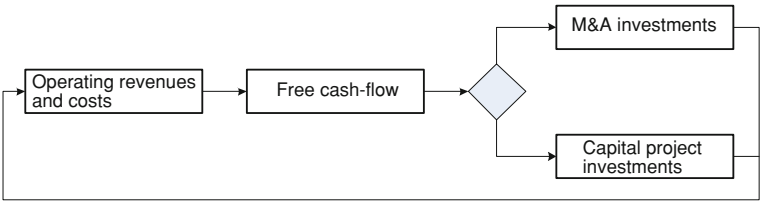

Fig. 9.1 The business goal of investments in major capital projects

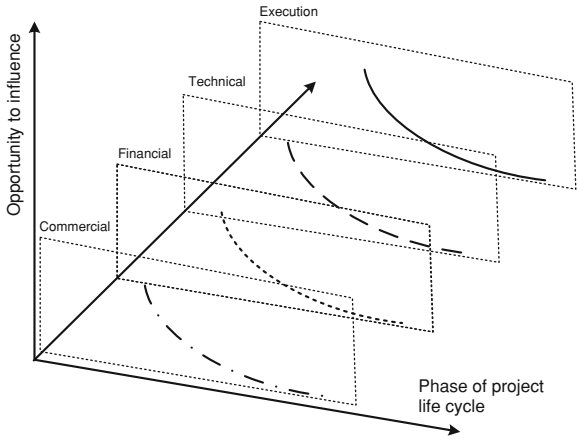

Fig. 9.2 The four planes of capital investment

These four planes of a capital project investment are illustrated by influence curves in Fig. 9.2. The curves show how management's ability to influence the outcome diminishes with time. The influence curve for each plane has a unique shape with its own points of strategic inflection. Since project definition matures at a different pace on each plane, the level of influence at any given point in time will be different.

Management decisions are often taken on one plane without full consideration of the implications of those decisions on the other planes, as well as how activities and decisions on the other planes may impact the decision at hand. These decision "silos" are often a cause of lost predictability as well as inefficient use of time, effort and funding in front-end activities.

Consider a multi-billion dollar, international capital project in a difficult location. Clearly, each of the above planes is complex in its own right. Most organizations involved in such projects engage an array of specialists—both internal and external—to help define, negotiate and document all the required elements. As the project progresses through the phases of early commercial development, concept definition, front-end engineering, and finally to financial close and sanction, each of these planes, of course, becomes better defined. Although complex, the challenge here is usually not one of being able to do the work on each plane (there is no

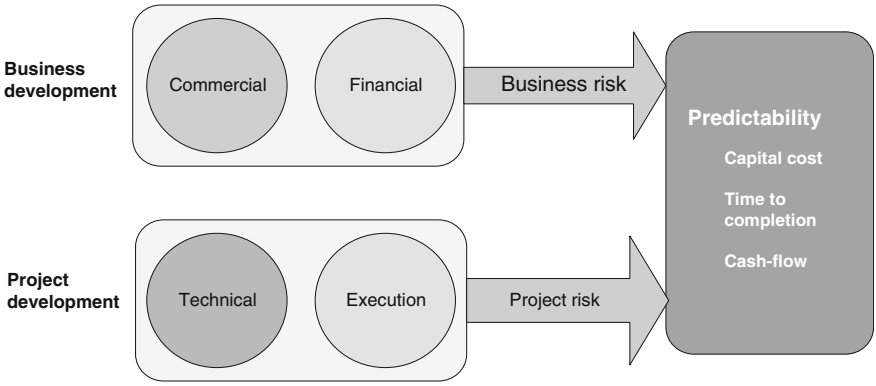

Fig. 9.3 Strategies and decisions describing business development

shortage of experts to draw upon). The real challenge is one of integration and interface management.

Let us now explore the definition and interaction of these four planes in more specific terms and see how a more holistic approach to decision-making, considering all four planes, can be applied.

9.2.3 Considering the Scope and Timing of Business and Project Decisions

There is a logical way to group the four planes: Commercial and Financial strategies and decisions are all part of *Business Development and Execution*. Likewise, Technical and Execution strategies and decisions are all part of *Project Development and Execution*. These four planes have business risks (strategic and contextual risks) and project risks (operational and contextual risks), respectively, which together determine the predictability of the outcomes of the capital project investment. This is illustrated in Fig. 9.3. The Commercial and Financial Planes define the strategies and decisions describing Business Development; the Technical and Execution Planes define Project Development. The boxes "Business development" and "Project development" are the same as the upper and the lower triangles (the time-glass) used in Fig. 7.5 representing the role of principal and the role of the agent, respectively. Predictability is a function of both the risks to Business Development (i.e. business risks), and to Project Development (i.e. project risks).

The scope of decisions involving capital project investments must consider all the relevant activities, goals, risks, and sensitivities of Business Development and Project Development as well as the associated business and project risks. Likewise, the plans along each of the four planes, which describe the activities and responsibilities necessary to develop the information needed for each decision

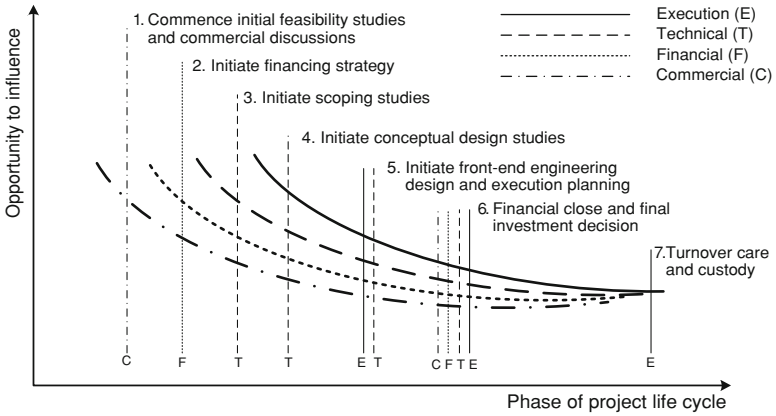

Fig. 9.4 Typical decision gates and where they might intersect work on other planes

point, must consider relevant activities, decisions and requirements from the other planes.

9.2.4 Considering an Integrated Set of Phases and Gates

The disciplined use of phases and gates to describe the project life cycle and critical decision points is a well-accepted method for inculcating the right priorities into an organization and ensuring that decisions are based on well-developed information. In most organizations, these processes are generally applied to project development.

Whether or not an organization has formal processes for business development, the "silos" that provide the core functions for each of the four planes typically make alignment, coordination and communication difficult. As a result, the people working on each plane tend to make simplifying assumptions about the strategies, decisions, and risks on the other planes. Eventually, this lack of alignment shows up as major changes in direction often resulting in significant re-direction or cost overruns and schedule delays.

Figure 9.2 illustrated the *influence curve* which indicates how management's ability to influence a project's outcome decreases with each phase in the project life cycle. The clear implication is that early, rigorous attention to definition and decisions is critical to predictable success. Let us now consider what happens if each of these four influence curves is imposed on the others (see Fig. 9.4).

For example, consider decision #4 in Fig. 9.4: *Initiate Conceptual Design Studies*. We see that this is typically an early decision gate on the Technical Plane, often marking the start of front-end loading activities that include strategic project planning such as procurement and contract strategies.

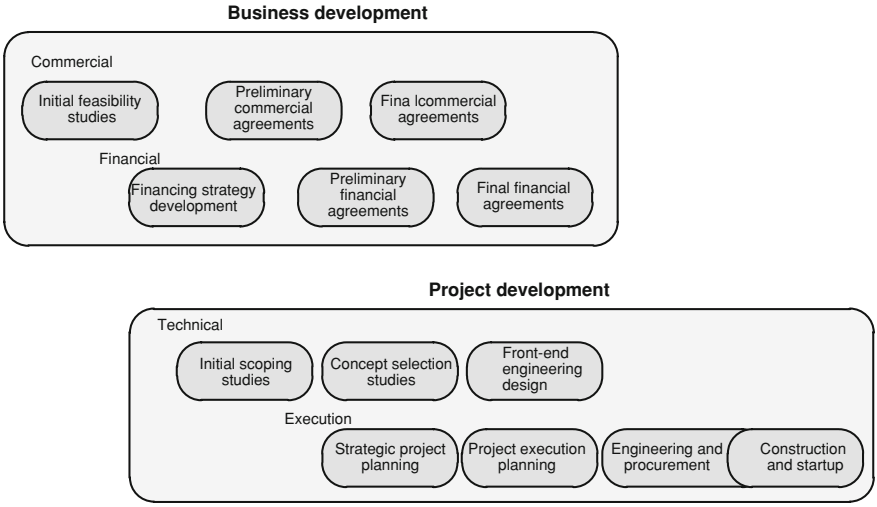

Fig. 9.5 High-level overview of the phases along each of the four planes

Project teams begin this work based on the results of scoping studies (on the Technology Plane). Figure 9.4 illustrates that, while the technical and execution work is still in its early phases, work on the Commercial and Financial Planes is often well-developed by this time. The developments, decisions and plans on the Commercial and Financial Planes will likely have important implications for how the work on the Technical and Execution Planes proceeds but, in most cases, this important dialogue never takes place.

What might a high-level description of a capital project's phases look like if all four planes were considered? Consider Fig. 9.5 in which the horizontal positioning of each phase provides a coarse indication of relative timing. Each phase is separated by a decision gate.

Here we see a straightforward representation of what an integrated, phased and gated business and project development process might look like. There are, of course, many dependencies between the work done in each phase on a given plane, and that done concurrently on the other planes. These are discussed further in the paragraphs below.

Now consider what happens if we combine the decision gates shown in Fig. 9.4 with the phases shown in Fig. 9.5. The traditional, facilities-centric phase-gate process now has a more holistic perspective as do the decisions at each gate. Figure 9.6 shows the integrated phase-gate process on each of the four planes of a major capital project investment. Decisions at each gate consider previous and upcoming decisions and activities on the other planes. Note that all four planes converge at the final investment decision and financial close.

It is easy to see that there are many interfaces and interactions between the activities in the four planes since most phases overlap. Strategies, plans and

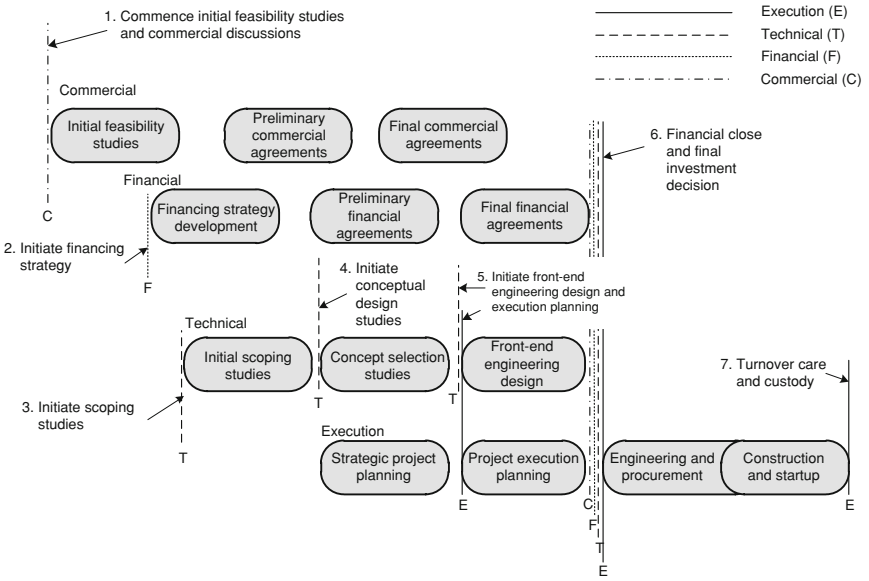

Fig. 9.6 Illustration of an integrated phase-gate process

decisions must consider these interfaces and interactions. Consider the example illustrated in Fig. 9.7. Changes in the preliminary commercial agreements result in changes to the priorities of the preliminary financial agreements resulting in changes to the work-plans and decisions on the Technical and Execution Planes. If we take this example further, we see in Fig. 9.8 that the changes made in the Technical and Execution Planes may, in turn, result in additional changes in the Commercial and Financial Planes.

As a result of these cross-functional interfaces and interactions, the company in this example made simultaneous changes to activities in the four planes in a timely manner. The company thus was able to identify the costly mistake (and self-imposed risk) of making commercial commitments that it could not reasonably be expected to meet.

9.3 Capital Project Due Diligence

Improving predictability is, of course, all about improving the decision-maker's understanding of project risk. There are significant barriers to the full and unbiased communication of risk to the executive decision-maker including:

- Rational economic behavior inhibits full disclosure and communication of project risks.

  In their book *Megaprojects and Risk*, Flyvbjerg et al. [4] examine the sources of the huge cost overruns on very major capital projects. Their research indicates

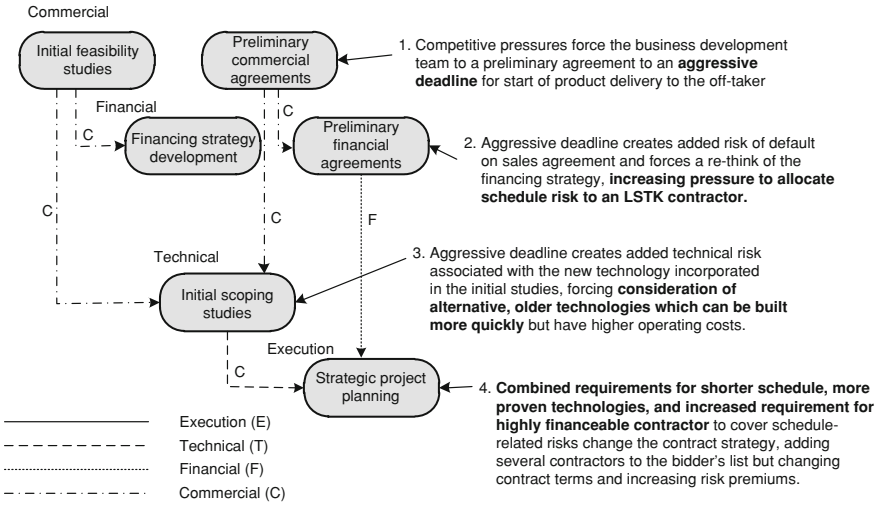

Fig. 9.7 Cascading impact of a development on the commercial plane

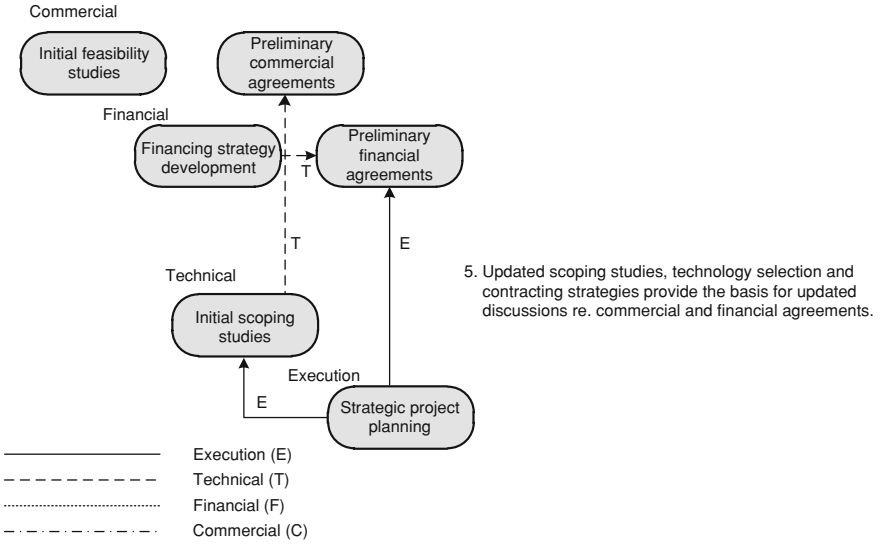

Fig. 9.8 Changed work-plans and decisions on the technical and execution planes

that rational economic behavior on the part of all participants drives the under-estimation of scope, difficulty, cost, time, and risk as well as the over-estimation of the benefits the project will bring. Whether deliberate or inadvertent, this bias to optimism causes important risks to be ignored and known risks to be

underestimated. When the actual costs of the project become apparent, in most cases it is not really a "cost overrun" so much as a reflection of the real cost.

- Different risk perspectives are never reconciled.

In their article *Owning the Right Risks*, Buehler et al. [2] describe a dysfunctional decision process, typical of many large organizations, in which each decision executive has a specific and narrow view of risks and associated responsibilities. As a result, key decisions are often made without the integrated risk perspective that might well have altered the strategies taken to implement them.

Both of these barriers are really about improving the way risks are discovered, assessed, and communicated. Given the structural barriers described above, it is clear that the best (perhaps only) effective way to ensure timely, risk-informed, strategic decision-making is with a due-diligence process designed specifically for the major capital project portfolio.

Figure 9.1 provided a simple illustration of how the preservation and growth in future free cash-flow is dependent on the wise investment of current cash flow in two ways: mergers and acquisitions (M&A) and capital projects (CAPEX). While the relative allocation of funds to these two types of investment varies from company to company and year to year, it is safe to say that CAPEX decisions are as important and difficult as those relating to M&A.

It is also safe to say that, when it comes to due diligence, CAPEX and M&A decisions are made quite differently.

Due diligence is an inherent part of the process by which M&A deals and decisions are made. Outside experts, with an independent, unbiased perspective, evaluate the opportunity in terms of risks and economic benefit. They assist in crafting and implementing commercial agreements, financial strategies and operational plans. Of course, the M&A investment decision is greatly enhanced by this external, unbiased perspective, and often the negotiations are as well.

Now compare the M&A process with that used for CAPEX decisions. When it comes to capital projects, most organizations rely primarily on *internal* processes to drive key decisions. These processes generally take the form of breaking the front-end of the project into several phases which are separated by decision gates. The front-end phases are followed by one or more execution phases, with the final phase being the long term operation of the facility.

These project development processes are typically designed around the Technology and Execution Planes described in Fig. 9.2 and in the following text. The processes are considered to be best practice that are credited with having improved predictability by increasing the level of project definition before the final investment decision is made. In some cases, external consultants are used to ensure all necessary project definition activities have been properly completed. Peer reviews may also be used to provide a "cold eyes" perspective, although those eyes typically belong to others within the same organization.

Unfortunately, even organizations who have front-end loading processes and who follow them rigorously have issues with predictability. Rather than ask "What

are we doing wrong?" they might ask instead, "What else should we be doing?" Consider this question:

Can the due diligence practices considered essential for M&A investments be adapted to CAPEX decisions and would doing so improve predictability?

Due diligence is generally defined as [1]:

> The process of evaluating a potential investment decision by investigating the financial, legal, and other material facts of the opportunity.

As Cullinan et al. [3] state in their article *The Secrets of Great Due Diligence*:

> Due diligence acts as a counterweight to the excitement that builds when managers begin to pursue a target.

Surely this is relevant to the CAPEX scenario as well.

Clearly, a capital project due diligence process must address all four planes (Commercial, Financial, Technical, and Execution) to make a more predictable CAPEX decision.

9.4 Capital Project Bankability

Capital project due diligence does not duplicate the due diligence activities surrounding the commercial and financial transactions. Its focus is entirely on the risks and predictability of the capital cost, time to first production, and the required cash-flow.

As illustrated in Figs. 9.4, 9.6, 9.7 and 9.8, the activities on each plane are impacted by the other planes requiring an integrated approach to planning and decision-making. Similarly, Fig. 9.3 illustrates how business and project risks combine to drive predictability.

Consider Fig. 9.9 which illustrates a capital project due diligence process. A due diligence review is required prior to the decision at each gate. The due diligence review provides an independent review of the status, progress, plans, issues and risks on each project plane then integrates these into the overall assessment of project risk exposure. These results drive risk-informed decisions and plans on each plane.

The importance of considering the combined risks on all four planes has been recognized by some major owner organizations who have introduced the standard of *bankability* as part of their project funding approval process. Before the final CAPEX decision is made, a proposed project must demonstrate that its predictability of success is such that a lender and/or passive investor would be willing to finance it. Experience suggests that the standard of bankability is very useful for ensuring that all the risks on each plane have been fully evaluated. It also provides a means to align the owner, operator, investors, lenders, and other stakeholders on a shared view of risks and the appropriate risk-informed project strategies. The bankability of a proposed project is illustrated in Fig. 9.10. The risks from each of

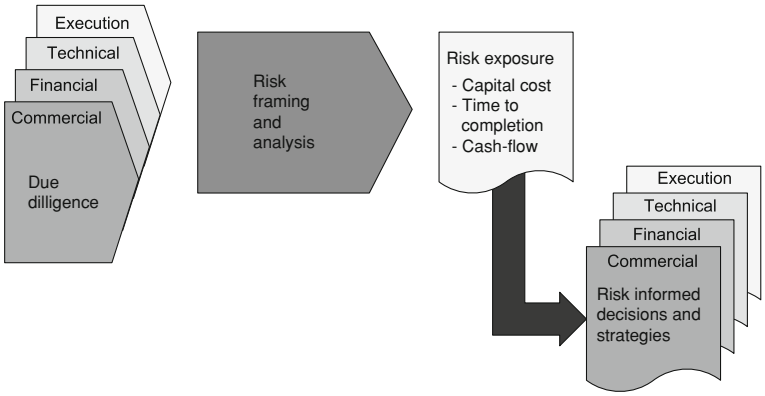

Fig. 9.9 Capital project due diligence process

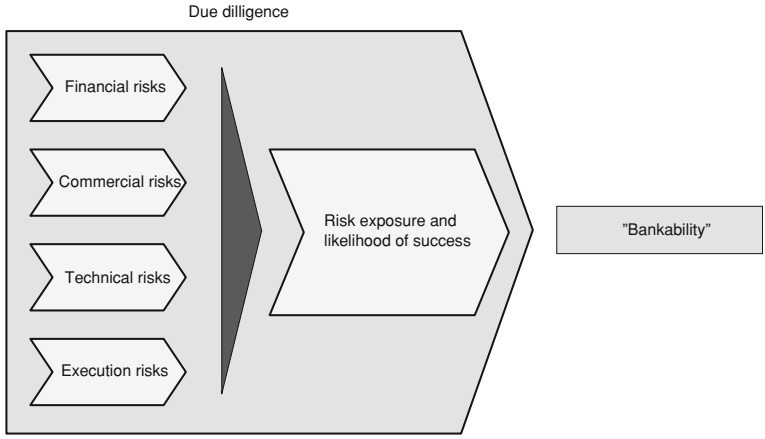

Fig. 9.10 Bankability

the four planes are considered and integrated to determine the overall likelihood of success. Even if the project will not require non-recourse financing, the CAPEX decision is evaluated as if it did.

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Chapter 10
A New Strategic Planning Model

10.1 Introduction

In this chapter an overview of the new strategic planning model for risk management will be discussed. It contains two iterative processes:

- *Project risk analysis.*
- *Project risk navigation.*

10.2 Project Risk Analysis

10.2.1 The Project Risk Challenge

The purpose of the project risk analysis process is to establish a fundamental and comprehensive understanding of the total project risk picture. The first step in project risk analysis, the point of departure, is a true understanding of the project challenge itself (see Fig. 10.1). An extensive description of project risks should address:

- Size
- Complexity
- New technologies
- New business practices
- Unfamiliar construction methods
- Remoteness of location
- Geopolitical context
- Ambitiousness of business target
- Sensitivity to corporate reputation.

A. Rolstadås et al., *Risk Navigation Strategies for Major Capital Projects*,
Springer Series in Reliability Engineering, DOI: 10.1007/978-0-85729-594-1_10,

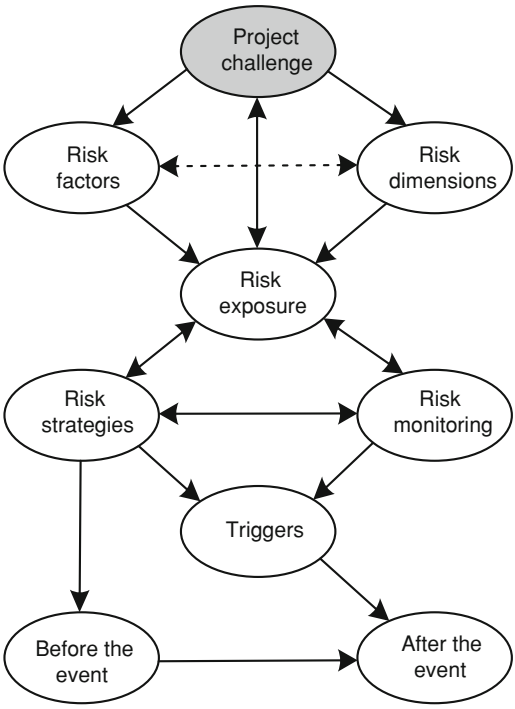

Fig. 10.1 Identifying the project risk challenge

10.2.2 Risk Factors

As a guide for how to assess the risk exposure of a given project, risk navigation provides an overview of *risk factors* to be considered. A distinction is made between risks related to state variables and to decision variables. *State variables* to be considered are:

- Volatility (day to day variations in relevant market prices and productivity).
- Extremes (weather, earthquakes).
- Accidents (construction damages, deaths and injuries, environmental damages).
- Unrests (labor force, impact caused by regulatory authorities and special interest groups).
- Bankruptcies (of suppliers).

In decision analysis, state variables are treated as *random variables*.
Decision variables to be considered are:

- Decisions made or to be made by project management.
- Decisions made or to be made by corporate management.
- Decisions made or to be made by external parties.
- Degree of communication.
- Level of understanding.

In decision analysis, decision variables are considered *intentionally rational variables* but limitedly so.

10.2.3 Conformance, Performance and Compliance Related Risks

Project Risk Navigation makes a distinction between three categories of decisions:

- *Conformance-related*
- *Performance-related*
- *Compliance-related*

Conformance-related refers to decisions of a technical nature, such as engineering, construction and commissioning. During the engineering phase, a large number of technical decisions are made; hence the technical plant gradually gets more and more defined. Conformance-related decisions gradually close the technical decision space. They are intentionally rational and often sequential in nature. Changes to conformance-related decisions are discouraged if the purpose is further optimization (leading to changes in design) but a must if the purpose is to correct for errors.

Performance-related refers to managerial decisions such as planning and control of work scope, execution processes, time, human resources and costs. Performance-related decisions are goal seeking or goal protecting. They are intentionally rational and highly dynamic in nature.

Compliance-related refers to a continuous monitoring of decisions, ensuring they are in compliance with governing laws and regulations and corporate procedures. Compliance-related decisions are typically administrative and "binary" in nature i.e. project decisions either comply or do not comply with the project's given execution procedures.

10.2.4 Risk Dimensions

In order to simplify the assessment of project risk exposure, project risk navigation provides a generic set of risk dimensions, grouped as operational, contextual and strategic risks. The risk factors and the risk dimensions in relation to other elements in the project risk analysis model are illustrated in Fig. 10.2.

10.2.5 Risk Exposure

The next step in project risk analysis is to prepare an assessment of the project total *risk exposure* at the project sanction decision gate (see Fig. 10.3). A bubble

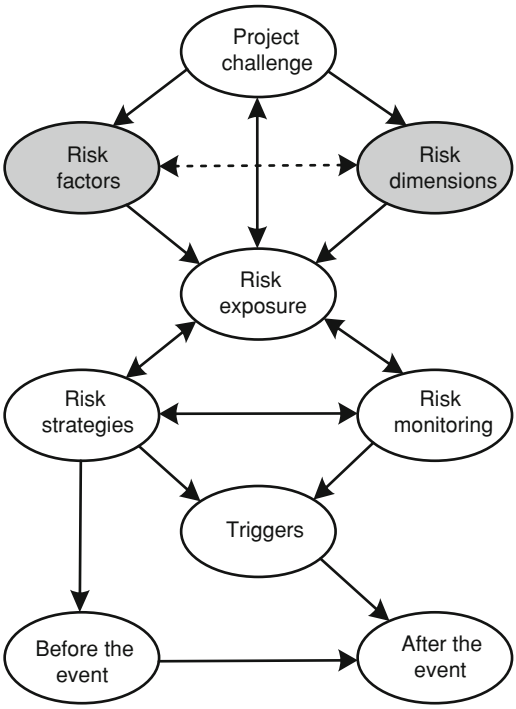

Fig. 10.2 Identifying the risk factors and the risk dimensions

diagram, where risks are positioned according to *likelihood of occurrence* and *effect on the project if occurring*, may be used to illustrate the risks of greatest concern. Separate bubble diagrams for operational, contextual and strategic risks will need to be prepared.

If the sum of all risks is too high, or the possible impact of a single risk may be fatal to project success, the project challenge will have to be revisited and reworked until the risk exposure is acceptable.

10.3 Project Risk Navigation Strategies

10.3.1 Effectiveness and Efficiency

The purpose of the project risk navigation process is to prepare project execution strategies that consider an appropriate handling of prevailing risks as they are likely to occur during project execution.

Conventional strategies focus on *risk reduction* and *execution efficiency*. Project risk navigation widens the focus to include the spectrum from *efficiency* to *effectiveness*. Efficiency focuses on *reuse and standardization* (previously referred to as Red Ocean strategies). Effectiveness focuses on *customization and innovation*

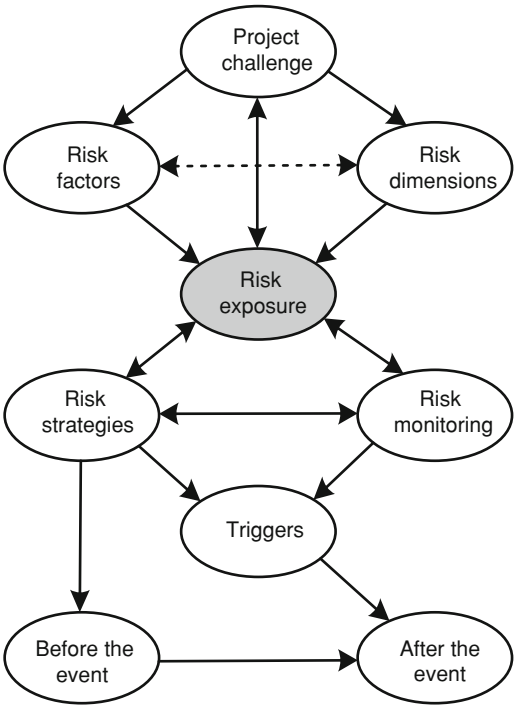

Fig. 10.3 Assessing the risk exposure

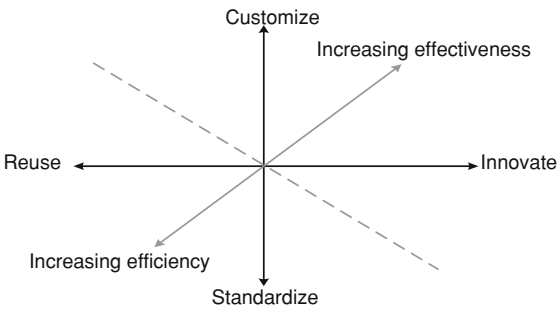

Fig. 10.4 Optional strategic directions

(previously referred to as Blue Ocean strategies). See an illustration of efficiency and effectiveness in Fig. 10.4.

The new project risk navigation process distinguishes between three different categories of project execution strategies:

- *Definitive concepts.*
- *Dynamic concepts.*
- *Option value.*

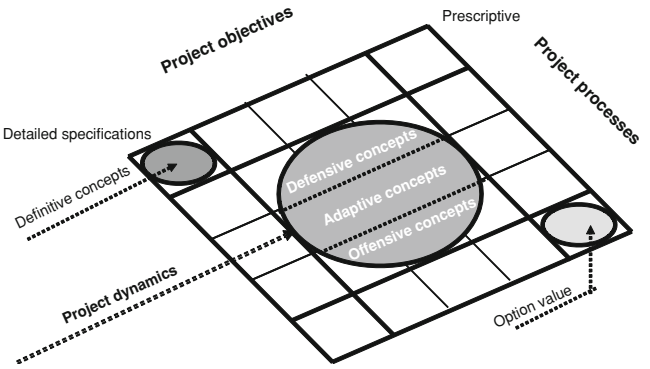

Fig. 10.5 Definitive project execution strategies

10.3.2 Definitive Concepts

Definitive concepts assume that uncertainties can be eliminated or at least reduced to an insignificant size in the sense that they cannot disrupt the project execution process. Project objectives are defined to the greatest detail. Project execution processes must follow narrowly defined procedures. In sum, the project is considered *completely determined with regard to what to do and how to do it* (see Fig. 10.5).

10.3.3 Dynamic Concepts

The *dynamic concepts* are characterized by acknowledging:

- Project uncertainties.
- The need for the project manager to have a certain freedom to act in order to keep the project on its planned track.

To accommodate the wide range in dynamic behavior, we introduce three groups of dynamic strategies:

- Defensive.
- Adaptive.
- Offensive.

The three groups of strategies are illustrated in Fig. 10.6.

As illustrated in the figure, *objectives* that drive dynamic strategies are formulated as:

- Functional specifications—as opposed to detailed specifications.
- Fuzzy targets—as opposed to well-defined targets.

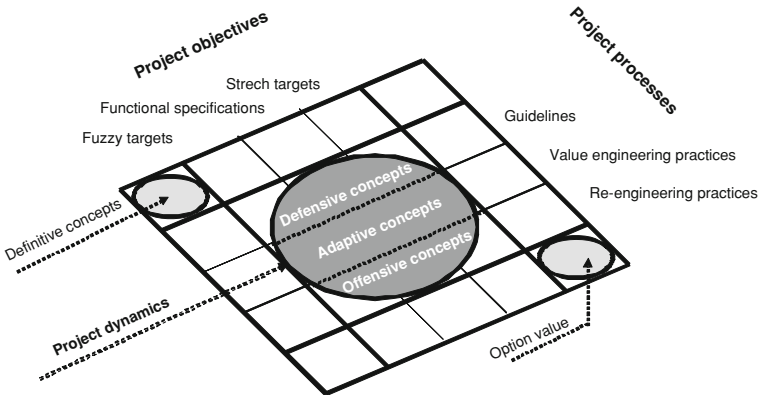

Fig. 10.6 Dynamic project strategies

- Stretch targets—as opposed to most likely targets.

Similarly the project processes are given the form of:

- Guidelines—as opposed to prescriptive procedures.
- Value engineering practices—as opposed to fixed design criteria.
- Re-engineering practices—as opposed to fixed design configurations.

Defensive concepts acknowledge the presence of project internal and external uncertainties. Uncertainty is, however, considered something "evil" from which the project needs protection. Defensive concepts are prepared to resist or absorb project risks. From a project planning perspective, defensive concepts imply the need for two measures:

- Buffers (risk premiums) that are added to expected time and costs estimates and
- Contingency that enables the project organization to bring the project back on track after the impact of a major shock

The first measure (buffers) is referred to as *robustness* and the second measure (contingency) is referred to as *resilience*.

Adaptive concepts assume the project manager stays *agile*, hence is prepared to act swiftly to side-step upcoming threats and to pursue project business value opportunities as they emerge. In order to work effectively, adaptive concepts require a flexible planning philosophy and a substantial delegation of authority.

Offensive concepts are designed to *drive change* through *aggressive* project objectives and working processes, continuously enhancing project business value over the project life cycle. We distinguish between two modes of offensive concepts:

- Versatile.
- Malleable.

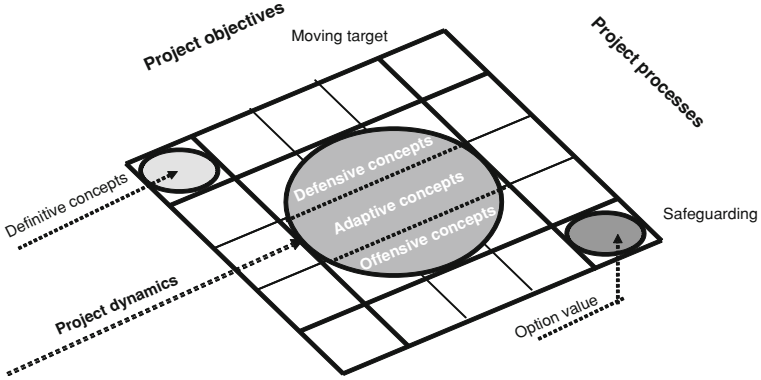

Fig. 10.7 Option value

In the *versatile mode,* the project manager drives change within the given project boundaries and within his or her level of authority. In the *malleable mode,* the project manager constantly challenges given boundaries and levels of authority as appropriate to drive business value.

10.3.4 Option Value

Finally, in the project execution phase, we introduce *option value* (see Fig. 10.7), a strategy designed to deal with moving targets and to safeguard the facility in the sense that the facility is prepared for potential future modifications and extensions.

More generally, option value could be understood as optional ways in which the project business value may be enhanced by viewing the project in its wider business context throughout the project execution phase. For a specific venture, option value may include the sale or acquisition of a project under execution in part or as a whole.

10.3.5 Before and After the Event Actions

Project execution strategies include *before the event actions* and *after the event actions*. Before the event actions are:

- Protective (buffers and barriers—absorbing or withstanding unexpected threats).
- Preventive (reduced likelihood of occurrence of risky situations).
- Contingency planning (establish resilience measures that can be deployed if required to bounce back from a major shock).

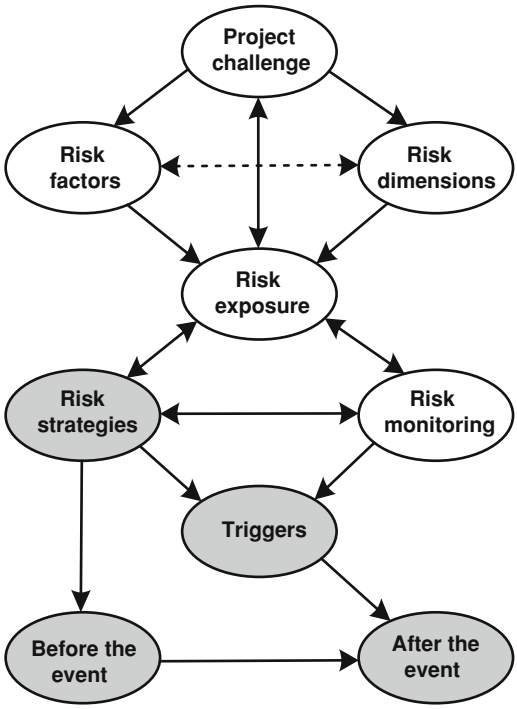

Fig. 10.8 The project risk strategies in contexts

- Enhanced flexibility (freedom and authority given the project team to navigate dynamically).

After the event, actions relate to contingency planning and enhanced flexibility. While *enhanced flexibility* is designed for day to day maneuvering along the planned project trajectory, *contingency planning* is designed to cope with events that represent major shocks to the project. To deploy contingency measures, *triggers* (see Fig. 10.8) are required to signal when to start reacting.

Part II
Summary

We discussed in more detail the three parts of the new approach to project risk navigation. We presented the Extended Project Risk Navigator with its three components:

- An improved governance system (Chap. 8)
- An improved decision process (Chap. 9)
- A changed strategic planning model (Chap. 10)

Initially (Chap. 5) we used a metaphor to illustrate our concept. We showed how George successfully manages to jaywalk in the streets of a major city using both explorative, adaptive and delivery-oriented behavior strategies (see Fig. 7.5).

We expanded our risk concept in Chap. 6. We discussed in more detail the three major categories of risk:

- Operational risk
- Strategic risk
- Contextual risk

In Chap. 7 we described the change process needed to prepare the future project manager for the challenges he or she must expect to meet. The change process is illustrated as a three leg journey:

- Explore
- Adapt
- Deliver

In Chap. 8 we discussed the governance system and emphasized the need to obtain a shift in mindset to be able to manage strategic and contextual risks in projects. We argued the need for a PEO as the future professional project manager. Finally we discussed the project ecosystem and argued that management of strategic and contextual risks requires a thorough understanding of the system of contractual relationships in the project.

In Chap. 9 we studied the project decision process in detail and demonstrated how the quality of decisions can be improved by concepts such us due diligence and bankability. We focused on plans and goals and described the four planes

(Commercial, Financial, Technical and Execution) of strategies, plans and decisions for CAPEX investments.

In Chap. 10 we conveyed some fresh thoughts on strategic planning. We discussed an approach to risk analysis and we discussed execution strategies. We distinguished between three concepts for project execution:

- Definitive
- Dynamic
- Option value

In Part III we continue with a discussion on selected aspects of how project risk navigation strategies can be implemented by following the concept of the Bermuda Risk Triangle.

Part III
Risk Navigation Tactics for a Reshaped Governance System

In Part III we will discuss selected aspects of project risk navigation tactics. We will focus on the governance system and discuss aspects of shifts in mindset, the project ecosystem and the role of the PEO.

Chapter 11 explores certain aspects of shifts in mindset. We focus on redefinition of project execution strategies and discuss:

- Definitive navigation concepts
- Defensive navigation concepts
- Adaptive navigation concepts
- Offensive navigation concepts

Chapter 12 explores some aspects of the project ecosystem. We focus on risk allocation at the contract level. We discuss different project contract perspectives, pricing of contracts, the contract management process and the allocation of risk.

Chapter 13 focuses on the proposed new role of a PEO. Project team performance is essential in this connection and we have therefore chosen to elaborate on this. This is also relevant both for the change process and for the project ecosystem. We propose a new framework for enhancing the effectiveness of teams and we discuss how we can measure the success of this new framework.

This Part III covers:

Redefining the project execution strategy
Allocating risk at the contract level
Enhancing the effectiveness of project teams

Chapter 11
Redefining the Project Execution Strategy

11.1 Introduction

In this chapter we focus on redefining project execution strategies. Five themes are being addressed:

- Strategies are different.
- Defining project value.
- How to add value—production focus.
- How to add value—operation focus.
- How to add value—business focus.

We start by claiming that one size does not fit all. As project challenges are different and project contexts are different, there is generally no one strategy that is fit for all project situations.

Departing from definitive strategies, considered appropriate in closed system perspectives on projects of the past, we introduce an array of dynamic strategies based on defensive, adaptive and offensive perspectives. The dynamic perspectives allow for navigating to enhance project value by maneuvering within a given frame of risk exposure. The objective of the project execution strategy is not to reduce project risks as is done in the traditional approach; rather, the aim is to maximize project business value without jeopardizing the project risk level that was established by corporate management at sanction.

This change of focus in preparing project execution strategies allows us to manage rather than reduce risks. This new perspective on risks is novel to the domain of project management but not to the domain of corporate management. The corporate risk level, often expressed in terms of a beta factor in financial markets, depends on the type of industry we are in. Corporate strategies address how to manage corporate risks, not how to become a risk free institution.

A. Rolstadås et al., *Risk Navigation Strategies for Major Capital Projects*,
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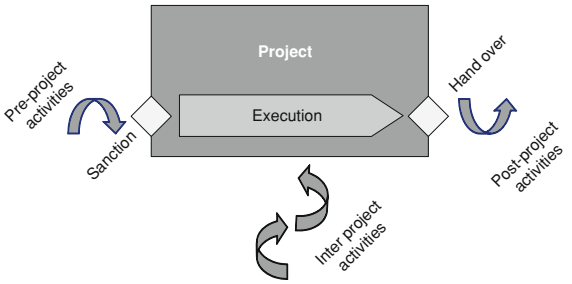

Fig. 11.1 Framing the project task

11.2 Execution Strategies

The traditional perspective views a project as a *production process* with distinct *start* and *end points*. For the purpose of this book, we refer to the production process as *execution*; the start point as *sanction* and the end point as *hand over* (see Fig. 11.1).

Prior to sanction a number of activities related to project start-up take place. Similarly a number of project related activities take place after hand over. These activities, referred to as *pre-project* and *post-project* activities, are of no concern to the traditional perspective. The project manager's ability to control the project execution process is highly dependent on the project maturity at sanction—the more mature, the more likely the project will meet its objectives. Further, emphasis on quality assurance and control is intended to secure operability of the plant when finished.

The core issue of the traditional perspective is the *planning and control* of activities in the execution process. In the following we will differentiate between planning and control in "the traditional world" and in "the new world". The traditional world techniques for planning and control assume we work in a closed system where everything is fully known or may be predicted with substantial accuracy. Deviations from execution schedules and budgets are referred to as either *planning errors* or *inappropriate controls.* The new world techniques are developed to navigate in an open or semi-open system where understanding of uncertainties and freedom to act are crucial competencies needed to steer the project to a successful completion.

During project execution, external factors, referred to as *inter-project activities* in Fig. 11.1, may influence project work positively or negatively. Some of these interferences relate to changes to project work scope or to the direction of the project made by the project owner.

In the following we will refer to project planning and control concepts in "the traditional world" as *definitive concepts* and planning and control concepts in the new world as *navigation dynamics*.

In the following we introduce and describe the key concepts of navigation dynamics. *Definitive concepts* (traditional world) disregard uncertainties. Project objectives are defined to the greatest level of detail. Project execution processes are designed to follow narrowly defined procedures.

11.2.1 Navigation Dynamics and Dimensions

The current body of knowledge for project control is heavily influenced by developments in production control. There are however some important differences between project control and production control:

- A project is a unique one-of-a-kind process; production is a repetitive process.
- A project is exposed to impacts from external environments; production takes place in a sheltered building or enclosure.

A further challenge for project control is related to the nature and aggressiveness of the project strategy. As discussed in previous chapters, project strategies often represent an interrelated set of strategies focusing on:

- The execution process (can it be produced on time and within budget?).
- Implementation of the project object (will it work as specified?).
- Project business value (will the project venture be as profitable as expected?).

Depending on the *nature of the strategy*, project control may be reduced to the classical perspective which ensures the work scope is either carried out on time and within budget or is expanded to include requirements related to operability and business value. The latter concerns often introduce conflicts of interests concerning the prioritizing between:

- Issues related to project completion (work scope, time and costs).
- Issues related to facility operation (implementation, operability).
- Issues related to business value (life cycle costs, net present value, reputation).

Depending on the *aggressiveness of the strategy*, project control must respond to several challenges including:

- More of the same.
- Incremental improvement.
- Radical change.

An *incremental improvement* could relate to a technical upgrade of some sort or a reduction in project execution costs or time by, say, 5%. A *radical change* could mean a brand new technical process, equipment that has not been used before, or a cut in project execution costs or time by, say, 50%.

To address these kinds of challenges, the project manager must master a variety of project control skills. We will introduce a skeleton of the nature of such skills in the form of the following concepts:

- Definitive navigation concepts.
- Defensive navigation concepts.
- Adaptive navigation concepts.
- Offensive navigation concepts.

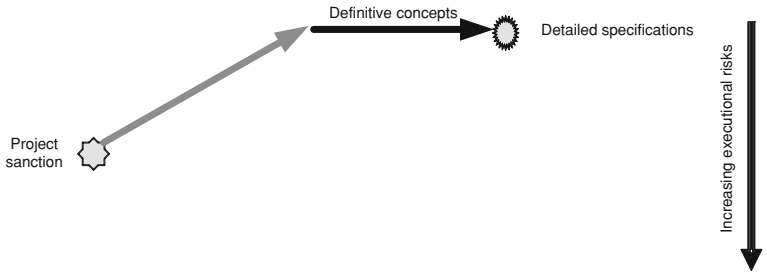

Fig. 11.2 Definitive navigation concepts

11.2.2 Definitive Navigation Concepts

As the project execution process proceeds, deviations between actual and planned states are explained as either *inappropriate planning* or *inadequate project control*—or a combination of these two. Projects of the type "more of the same" are candidates for *definitive navigation concepts* as the project challenge is assumed to be well known. Best practices for "more of the same" type of projects focus on reuse of existing drawings, technical specifications and project procedures. Further, the project organization is often staffed by personnel with comprehensive experience from a similar type of project. Generally, definitive navigation concepts ensure you get what you specify if you repeat what you did last time. Incremental improvements may be assumed to take place as you strive to avoid errors and omissions from prior projects. Further, repetition in itself will probably ensure an improvement in productivity.

To be applied successfully, definitive navigation concepts require the project to be completely defined, hence a significant level of maturity in defining what to do (project objectives) and how to do it (project execution procedures) is required. Such criteria often are not met at the early phases of the project. A definition period is required before the project can be formally sanctioned. This two-stage process is illustrated in Fig. 11.2.

11.2.3 Defensive Navigation Concepts

Defensive navigation concepts acknowledge the presence of project internal and external uncertainties.

According to Chin [1], project internal uncertainties relate to:

- Technical obstacles.
- Project Plan changes.
  - Schedule.
  - Scope.

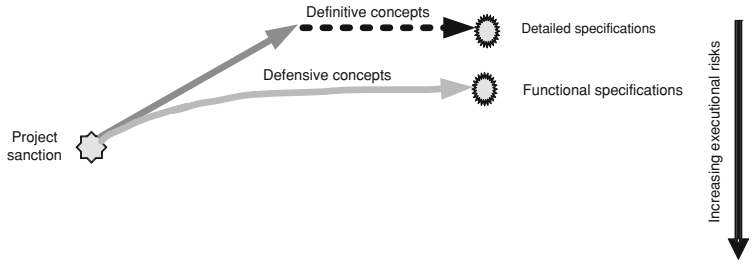

Fig. 11.3 Defensive navigation concepts

– Resources.
– Trade-offs and decisions.

These kinds of uncertainties are often similar to what we address in production control. However, as projects are considered unique, knowledge transfer from project to project is much more difficult as it is for repetitive production processes.

Similarly, project external uncertainties [1] relate to*:*

- Changing customer requirements.
- Competitive moves.
- Changes in industry-specific business environments.
- Changes in business strategy.

These kinds of uncertainties are often considered external factors to production processes, hence outside the domain of production controllers.

In defensive navigation concepts, external and internal uncertainties are considered to be risks; hence risk mitigation concepts are welcome.

According to defensive navigation concepts, project risks should successively be reduced to an appropriate minimum prior to sanction. Often a phase-gated approach is applied in the project development process to ensure that a successive risk reduction process takes place as illustrated in Fig. 11.3.

For complex capital projects, the *project budget* at the sanction point is of major concern. Project owners therefore often require that uncertainties in the project cost estimate are within a certain range, say, $\pm 15\%$ for an 80% confidence interval. The budget itself is often set equal to the expected costs (50/50 estimate) with the addition of a risk premium. The implication of this procedure is that there is, say, a 70% probability of the actual costs being within the sanction budget. Such a sanction budget is often referred to as a 70/30 or P70 estimate.

Defensive navigation concepts for the execution phase focus on a combination of the following actions:

- A continuous monitoring of developing major threats (typically the ten most threatening events that may happen).
- Investment in robustness measures.
- Preparation of resilient measures.

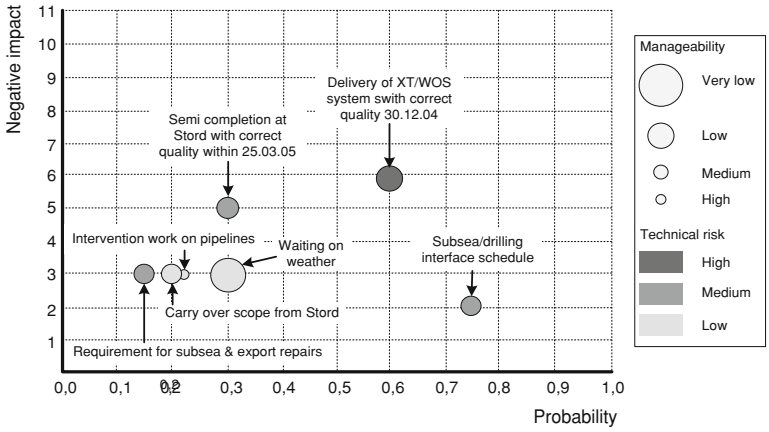

Fig. 11.4 Representation of major threats (Statoil Kristin project) [3]

Major threats are often presented in a bubble diagram. See Fig. 11.4 for an example.

As indicated in the figure, the ranking of threats is based on a combination of likelihood of occurrence (probability) and negative impact on the project if the threat materializes.

Robustness measures are buffers designed to absorb unexpected increases in costs or time. A P70 sanction budget includes a risk premium which is an example of a robustness measure for capital expenditures.

Resilience means the ability to bounce back from a major shock. As a navigation concept, resilience implies the project organization is prepared to cope with unexpected events that may threaten the project if they occur. Resilience may take the form of a resource contingency or a resource buffer, in the sense that extra personnel or material resources may be deployed on short notice to deal with an unplanned emergency situation.

11.2.4 Adaptive Navigation Concepts

In order to work effectively, *adaptive navigation concepts* require a rather flexible planning philosophy and a substantial delegation of authority to the project team. Chin [1] contrasts agile planning with classic planning (definitive navigation concepts) in the following way:

- Agile planning is a continuous process spanning the entire project, composed of a moderate up-front effort followed by lower-level but constant updates.
- Classic planning is a distinct project phase, composed of a large up-front effort followed by small updates.

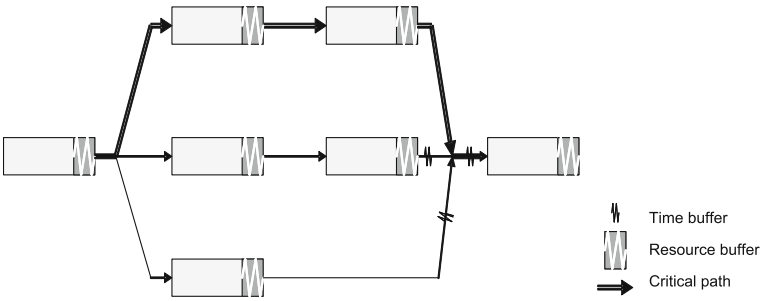

Fig. 11.5 Adaptive navigation of time (Statoil TOPP project) [3]

We have previously positioned agility as an adaptive strategy. An implication of this is that we do not consider agile as a navigation concept for *driving project change*. However, the implementation of agile concepts does add business value through a combination of three processes:

- Continuously scanning for and side-stepping future problems.
- Continuously scanning for future opportunities and harvesting these opportunities as they emerge.
- Speed in decision making.

Chin [1] stresses that agile does not equal fast in agile project management. However, speed is a multiplying factor of agility.

An implication of speed is that the project execution plan must be made flexible in the sense that interventions can be made as and when required. Figure 11.5 illustrates a flexible navigation concept by means of time and resource buffers.

Time buffers are robustness measures. In this case, time buffers are used to reduce time complexity by blocking certain paths in the network schedule from becoming critical.

Initially, resource buffers were developed as means of resilience. If a major delay occurred, it could be recovered by an increase in the labor force. The concept may, however, be extended to view a resource buffer as a means for the project manager to increase and decrease the resource intensity as appropriate to side step problems and to harvest emerging opportunities.

In previous chapters we suggested that agile strategies in particular were attractive in situations where the project objectives were formulated in one of the following ways:

- Functional requirements.
- Fuzzy targets.
- Moving targets.

The way these objectives are formulated indicates that project team, operating in an agile mode, strives to achieve business results rather than limit its focus on delivering the project as specified, on time and within budget [1].

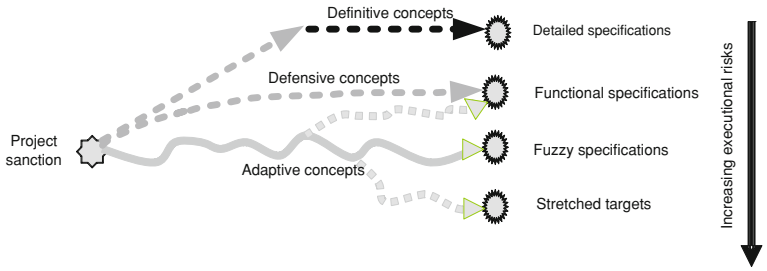

Fig. 11.6 Adaptive navigation concepts

Situations recommended for use of agile (adaptive) navigation concepts are illustrated in Fig. 11.6.

11.2.5 Offensive Navigation Concepts

In *offensive navigation concepts*, the project manager deliberately drives change to add project business value over the project life cycle. In Chap. 10, we distinguished between two different types of offensive navigation concepts:

- Versatile.
- Malleable.

In a *versatile navigation concept*, the project manager sets out to drive change within his or her limit of authority. Current definition of work scope, working logic, working procedures, schedules etc. are continuously challenged in search for faster or cheaper ways to carry out project work. Techniques from value engineering, value management and total quality management are applied as appropriate.

In a *malleable navigation concept*, the project manager sets out to drive change by challenging both the boundaries of the project and his limit of authority. Methods drawn from creative thinking (concepts related to lateral thinking) and business process re-engineering are considered appropriate to drive change in a malleable mode.

As illustrated in Fig. 11.7, offensive navigation concepts are considered appropriate in situations in which the project manager is driven by project objectives given as stretched and moving targets.

11.3 Project Business Value

11.3.1 Framing the Owner's Project

Over time, the focus on complex capital projects has changed from a traditional focus on *delivery* (as specified, on time and within budget) to a new focus on *what the deliverable is for* (the business rationale for delivering the project). Looking

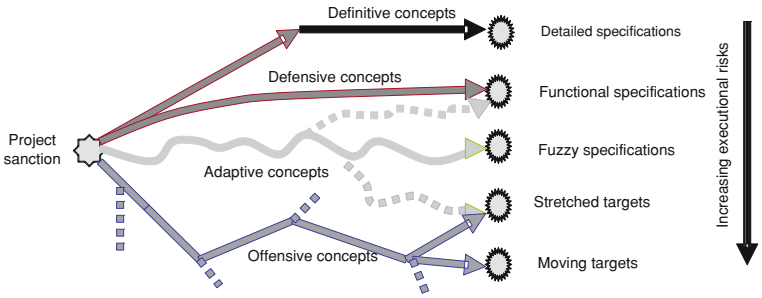

Fig. 11.7 Offensive navigation concepts

forward in time, we see an emerging interest that the project must adapt to *environmental conditions* in order to be delivered successfully (the new approach).

We are already familiar with framing of *project management of the past* (see Fig. 11.1).

Although traditional perspectives on project management continue to claim that a project should be completed as specified, on time and within budget, there are additional requirements such as operability and project business value that must be addressed in the new approach.

In the past, trade-offs had to be made between scope of work, time to completion and execution costs. The priority of these trade-offs depends on the parameters of the project. In the new approach, these trade-offs now have to include operability and project business value.

As projects in the "new world" operate in a semi-open to an open system compared to the closed system of the "traditional world", this statement is not necessarily true anymore. The project context has changed. As projects in the "new world" are not fully determined at sanction, we have the opportunity to be flexible and open to innovative solutions e.g. you do not have to trade-off, say, costs against time, you can reduce costs and time simultaneously. Given sufficient degrees of freedom to act, such trade-offs may be unnecessary.

The framing of a project in the new world is illustrated in Fig. 11.8.

We see that the framing of projects in the past, Fig. 11.1 is extended to incorporate pre-project and post-project activities. Two new project phases, referred to as *development* and *implementation*, are now added. In the development phase, the project is co-developed between a *corporate business development team* and a *project execution team*; similarly the project execution team will co-work with an *owner operation team* in the implementation phase to ensure the facility is functioning properly before being put into operation.

These three teams (corporate business development, project execution and owner operation) are often represented in a *core team* accountable for the whole value chain. The core team is headed by a *venture manager*. The life cycle of the business venture is indicated by the decision points and arrows in Fig. 11.8. The following key decision points (go/no go decisions) are indicated:

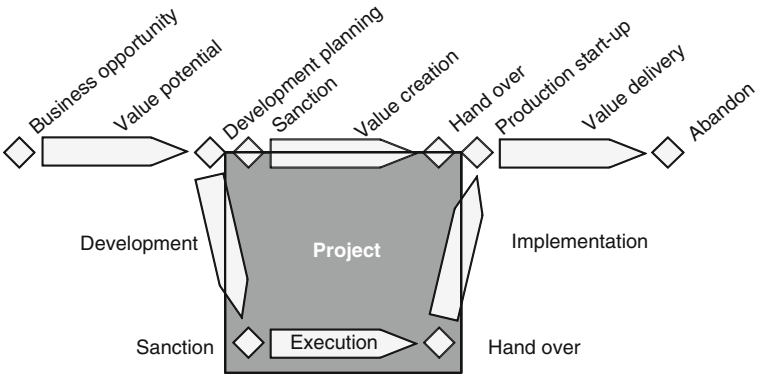

Fig. 11.8 Project as means to enhance business value

- Business opportunity (start planning the business case).
- Development planning (start facility development planning).
- Sanction (approval of the project execution budget).
- Hand over (start commissioning of the facility).
- Production start-up (start operation of the facility).
- Abandon (close down and remove/demolish the facility).

Further, we distinguish between the following phases of the business venture:

- Value potential.
- Value creation.
- Value delivery.

Value delivery refers to value of the products produced by the facility once in operation. *Value potential* means that the business venture at this stage has no sales value. *Value creation* refers to the middle phase of the business venture. The notion of value being created means that the project by now has a resale value.

The *primary business context* of the project (the venture) is illustrated in Fig. 11.9. Venture management takes place within a *corporate context*.

Figure 11.9 places the project in an internal environment (business case/venture and corporate). In Fig. 11.10 the concept is extended to incorporate the environment external to the project owner organization.

There are many forces in the project owner's external environments that may have a significant impact on the project including:

- Markets.
- Business practices.
- Culture.
- Geo-politics.

Markets relate to markets for products to be produced by the facility and factor markets, i.e. markets for suppliers of materials, equipment and project services.

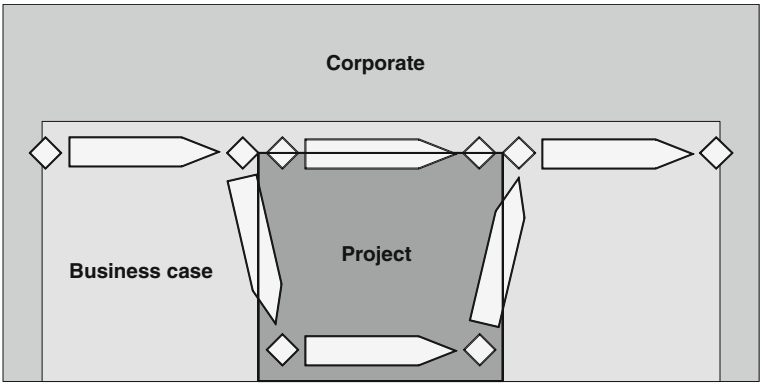

Fig. 11.9 The project owner's project context—the internal environment

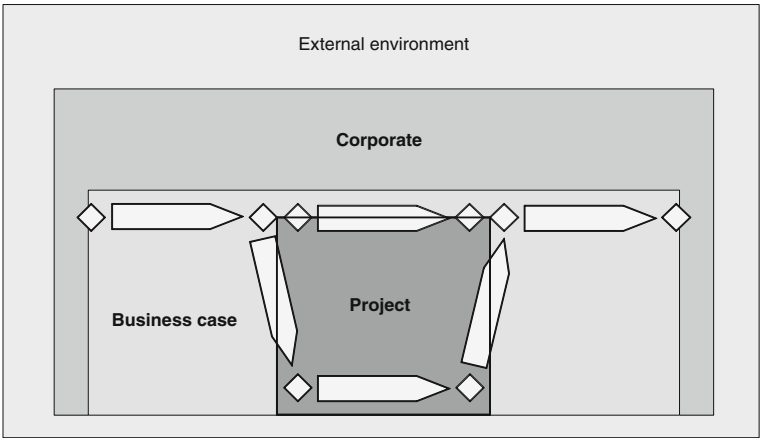

Fig. 11.10 The project owner's project context—the external environment

Business practices may restrict new ways of executing project work. *Culture* is a crucial factor when it comes to leadership in general and, more specifically, to communication internal and external to the project. *Geo-politics* may play a major role as governments make rules and regulations that could jeopardize the project execution processes.

11.3.2 Framing the Project: The Supplier Perspective

So far focus has been directed towards the project owner's perspective. A similar outline may be given from a supplier's perspective. In Fig. 11.11 a typical situation for a prime contractor is illustrated.

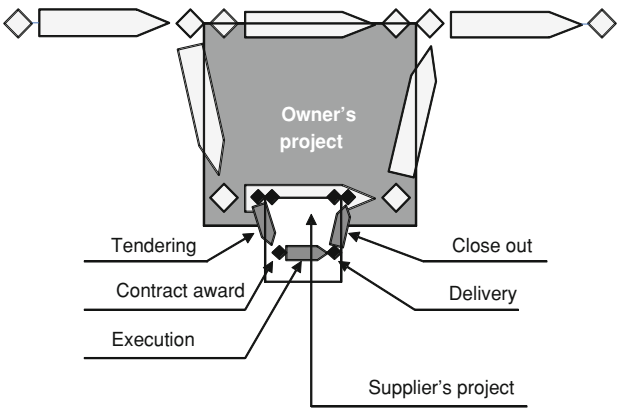

Fig. 11.11 Framing the project—the supplier's perspective

As mentioned earlier, complex capital projects are driven from an owner's perspective. After sanction, suppliers are invited to tender for deliverables of materials, equipment and services. Contracts are awarded to the successful bidders.

After fulfilling rendered products and services, the delivery is formally accepted and the contract is closed. Details on tendering, contract administration and close out of contracts are not discussed in this book.

As for the project owner, the suppliers have their own framing of their project constructs and relevant contexts, represented by corresponding internal and external environments as shown in Figs. 11.12 and 11.13.

11.3.3 Defining Project Business Value

As mentioned previously, complex capital projects are driven by a project owner in need of a facility of some kind. The project business value, viewed from the owner's perspective, is determined by what the owner wants to do with the facility. Viewed from a facility operation perspective, the project business value may be expressed in terms of a net present value which is a function of:

- Capital costs for the design and construction of the facility (CAPEX).
- Costs for the operation of the facility (OPEX).
- Production profile.
- Sale of products produced by the facility.
- Taxes.
- Costs related to close down and removal/demolition of the facility at the end of production.

When calculating the net present value of the business venture, adjustments are made to correct for risks and option value (*flexibility*).

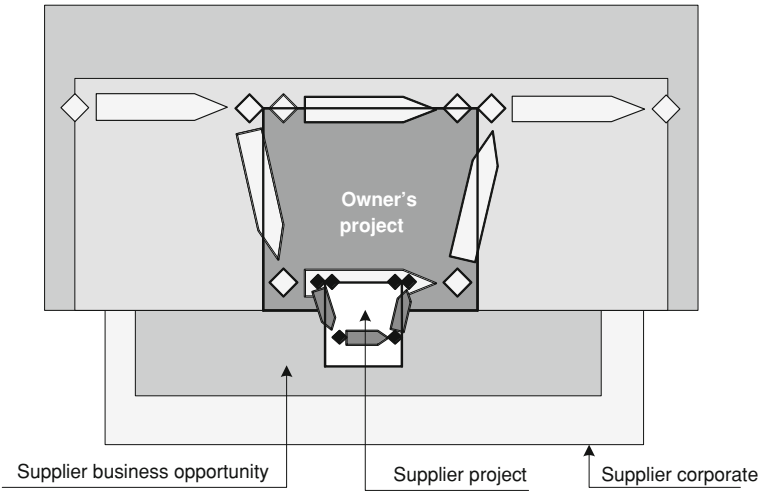

Fig. 11.12 The supplier's project internal environment

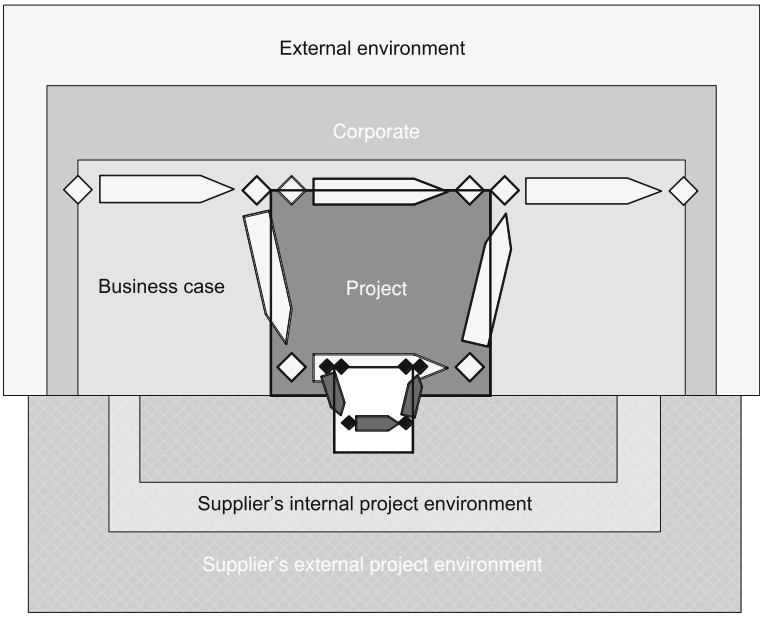

Fig. 11.13 The supplier's project external environment

An alternate way of viewing the business value of the venture is to start with the sales value of the products (planned to be produced) for the remaining life of the

production profile. After deductions for operational costs, taxes, costs related to close down and removal/demolition of the facility and simultaneously correcting for risks and option value, the discounted net difference equals the business value of the facility if sold.

As discussed earlier in this chapter, the business value of the venture develops through three stages:

- Value potential.
- Value created.
- Value delivered.

From the project owner's perspective, the focus is on *value created*.

Our point of departure is a project planned and executed in the "traditional world" mode. At sanction, the project objectives are fully determined and the working procedures are extensively prescriptive. Uncertainties in state and decision variables are ignored. In such a situation, if correctively modeled, actual costs will equal expected costs. The project business value at the time of hand over will then equal the business value at sanction. No value has been added. However, *the value potential at sanction will gradually be transformed into value created at hand over*.

On the one hand our interest is partly in *gradual transformation* from one type of value to the other. This aspect is important from a project accounting point of view. According to national standards for project accounting, actual costs incurred are booked and accumulated over the complete project life cycle (development, execution and implementation) and referred to as *value created*.

The accumulation of incurred costs may, however, be wholly or partly written off if, say, the project after being sanctioned is cancelled or major changes are made to the facility under construction in such a way that the whole or parts of the facility becomes obsolete. In these cases, incurred costs that are not recoverable are considered sunk and written off.

On the other hand our interest is in *value that is being added,* or, in some cases, lost in the execution phase. In the following, this aspect is viewed from three complementary perspectives:

- Production focus.
- Operation focus.
- Business focus.

Similarly to the project owner, the suppliers have their own business perspectives. Supplier project business value is expressed in terms of *contract margins* which may be counterproductive to the project owner's objective to add and transform project business value in the execution phase.

The prime foci for addressing project business value from the project owner's and the supplier's perspective are illustrated by complementary circles in Fig. 11.14.

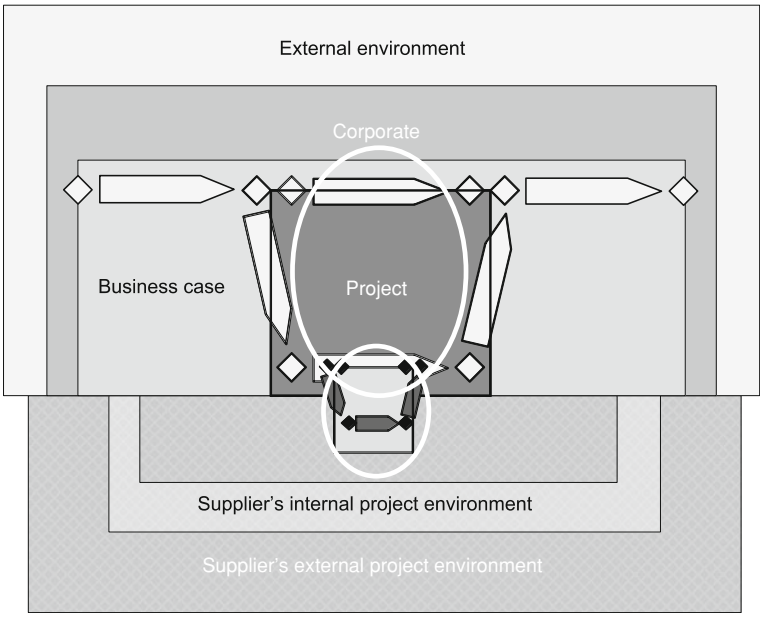

Fig. 11.14 Defining project business value

11.4 Value Adding: Production Focus

In determining how project business value may be enhanced in the execution phase, we focus on the production process itself. As outlined in previous chapters, we have to distinguish between the following archetypes of projects:

- More of the same.
- Incremental improvement.
- Radical change.

11.4.1 More of the Same

In the *more of the same* case, business enhancement is trivial in the sense that there are no explicit expectations for the delivery of the project. According to this perspective, the project business value should be safeguarded by ensuring the project will be delivered as specified, on time and within budget. As outlined previously, definitive navigation concepts are considered appropriate to ensure the *more of the same* focus is maintained.

11.4.2 Incremental Improvement

In the *incremental improvement* case, expectations as to what is to be improved and by how much are likely to be given. Project objectives will be given in the form of either fuzzy or moderately stretched targets. Some freedom is given to the project organization to accommodate such targets, hence given project execution procedures are meant as guidance rather than prescriptions. As outlined previously, defensive and adaptive navigation concepts are considered appropriate to ensure the *incremental improvement* focus is maintained.

Incremental improvements that may be triggered by the project organization in the execution phase could affect:

- Execution costs (CAPEX).
- Time of delivery/hand over.
- Operability of the facility.

As materials for projects are delivered by vendors and engineering and construction work is undertaken by contractors, the focus of the project owner will be on:

- Competitive bidding to benefit from market forces.
- Selecting low bidders.
- Encouraging cost efficient working processes.
- Efficient managing of project supplier interfaces.

The focus of the supplier will be on:

- Winning bids.
- Enhancing the margin between contract price and the suppliers production costs.

Cost-based contracts may expose the owner to moral hazard while high risk price-based contracts can lead to inappropriate premiums to account for the high level of risk. Both types of contracts are counterproductive to reducing project execution costs. In order to avoid a possible win-lose or lose-win situation between the project owner and the suppliers, contract incentives could be applied to align competing interests.

11.4.3 Radical Change

In the *radical change* case, expectations may be very high compared to the incremental improvement case. A project objective implying execution costs should radically be cut by, say, 30–50% is definitely a different challenge. As outlined previously, offensive navigation concepts are to be applied if such a change should materialize. Project objectives should be given in terms of highly stretched or moving targets; hence project execution processes deliberately driving change will have to be enforced.

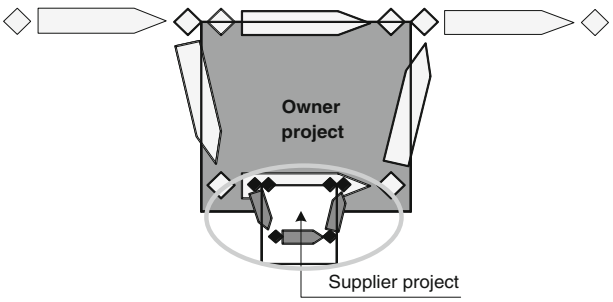

Fig. 11.15 Project value—production focus

Radical projects are delivered by contracted suppliers in a similar manner as for *more of the same* and *incremental improvement* projects. In order to drive radical change on the project, the supplier must be encouraged to radically reduce his production costs. Consequently, the owner will need to offer contract incentives to support such radical cost reduction.

The project execution cost is more than the sum of individual contract costs. The *transaction costs* related to selection and administration of suppliers, *costs related to contract interface management* and *costs related to overall management of the project* must be included.

As viewed by the project owner, the production focus perspective strives to reduce project execution costs. A reduction in capital expenditures (CAPEX) affects the project business value. The implication of this is twofold:

- Added project business value through an increase in net present value.
- Reduced need for financial resources.

As viewed by the supplier, the production focus perspective strives to increase contract margin. The supplier will seek to increase his contract margin by:

- Increasing the contract price.
- Increasing the scope of work.
- Reducing production costs.

It should be noted that, once a supplier is committed, the project owner is locked into a situation whereby variations in the scope of work are implemented by the selected contractor without competitive bidding.

An illustration of the production focus perspective is shown in Fig. 11.15.

11.5 Value Adding: Operation Focus

In determining how project business value may be enhanced in the execution phase, we now extend the focus from the production process itself to the impact on the *operation* of the facility.

Prior to production start-up, the project is handed over to an owner operating unit for commissioning and operation. As a result, we must manage risks during activities in two subsequent but dependent phases:

- Effective and efficient commissioning activities in the implementation phase.
- Effective and efficient operating activities in the operation phase which extends from start-up to abandonment of the facility.

11.5.1 Commissioning

Effective commissioning refers to the ability of the equipment and process systems to work as designed. This further implies that the facility was constructed as planned. *Efficient commissioning* refers to the costs of commissioning the facility. Engineering omissions and errors often lead to increases in commissioning costs. From a project owner's perspective, engineering omissions and errors can also result in higher capital costs as well as delays in the start-up of the facility. These cost increases and delays in start-up can decrease the project business value.

11.5.2 Operation

Effective operation relates to how well the equipment and process systems work technically over the production life of the facility. For example, the operating life of rotating equipment can be, say, 15 years. Process systems may be designed for a 95% availability which implies some down time has been planned for inspection, replacement of worn out component, reparations etc.

The impact of deviations in effective operation has a direct impact on the flow of products produced by the facility. Delays and shortfalls compared to the planned production profile negatively affect project business value through a reduction or postponement in the revenue stream. Similarly, an improvement in effective operation will increase production volumes and enhance revenue streams, hence having a positive effect on the project business value.

Efficient operation refers to the costs of operating the facility (OPEX). Quality problems that arise from problems related to the functioning of and the operability of equipment, process and support systems including structural components, may be traced back to omissions and errors in the design, engineering and construction of the facility. In this sense, inadequate project execution processes may affect the operability of the facility that emerge years after the project has been handed over to an operating unit.

An illustration of the operation focus perspective is shown in Fig. 11.16.

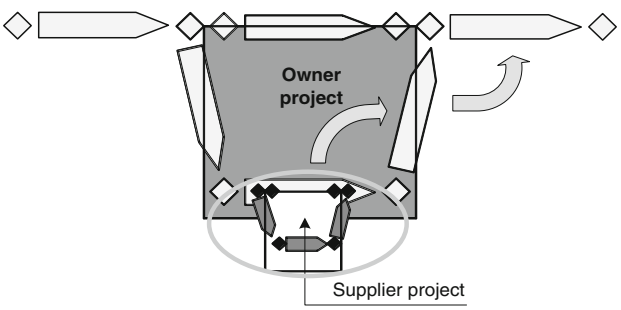

Fig. 11.16 Project value—operation focus

11.6 Value Adding: Business Focus

In determining how project business value may be enhanced in the execution phase, we now extend our focus beyond production and operation to the impact that the project has on the business itself.

To this point, our focus has been on parameters that affect the project business value including:

- Project execution costs (CAPEX).
- Costs of operating the facility (OPEX).
- Availability of the facility to sustain the planned production profile.

As noted previously, a delay in delivery of the project or a delay in the start-up of the commissioned facility will negatively affect the project business value. Some delays may be recovered but at an increase in costs. Delays that are not recoverable lead to a postponement of the production profile, hence negatively affecting the net present value.

Previously in this chapter we linked our understanding of project business value to definitive and defensive navigation concepts for project execution. We now turn to adaptive and offensive navigation concepts to enhance project business value.

11.6.1 Adaptive Navigation Concepts for Enhancing Project Business Value

Adaptive navigation concepts may add project business value in the following ways:

- By staying agile so that emerging risks may be side stepped.
- By harvesting emerging upside potentials.
- By maneuvering swiftly.

The first two ways indicate that the project internal and external environments are far from given and static. The project's surroundings are constantly moving. Consequently, situations emerge that have not been identified nor planned. These situations arise independently of how the project objectives are formulated. Such situations embrace risks as well as opportunities. In the world of definitive navigation concepts, this reality is ignored and in the world of defensive navigation concepts this reality is solely considered as a threat.

Project business value may be further enhanced beyond defensive navigation concepts if the project manager: (1) can acknowledge that unidentified and unplanned situations may occur, (2) is able to recognize an opportunity as it emerges from these situations and (3) acts swiftly to exploit these opportunities.

If, say, a vital contract on the critical path finishes 2 months early, the project hand over may take place 2 months ahead of schedule meaning that start-up may commence 2 months early. However, to exploit such an opportunity, the project manager must foresee the possibility that this can happen and is prepared to make timely adjustments to other schedules as appropriate. If the opportunity is successfully exploited, the project owner will benefit from an increase in the net present value of the project. The supplier may also be a beneficiary through a gain-sharing contract arrangement that encourages the supplier together with the project team to complete the project early.

The ability to act swiftly is a project business value driver in its own right since speed may compensate for elaborate buffers in terms of cost and time.

Adaptive navigation concepts are not limited to time and cost. For example, functional specifications can be used to focus on the operation of various pieces of equipment and processes rather than their physical characteristics. Further, the use of guidance documents that are descriptive rather than prescriptive can encourage contractors to manage their own work processes as opposed to being told by the project owner how to do the work.

11.6.2 Offensive Navigation Concepts for Enhancing Project Business Value

Offensive navigation concepts apply in situations where significant improvements or radical changes are targeted to take place in the execution phase. Typically, decisions to apply offensive measures are triggered if a project needs to bounce back from major shocks such as unexpected changes in market conditions, geopolitical contexts and other external events or interventions. If any of these shocks had been foreseen or planned, resilient measures would have been included in the project execution strategy prepared during the development phase. However, when shocks are unforeseen or unplanned, the project manager must instantly prepare and implement bounce back plans or corrective strategies during the execution phase.

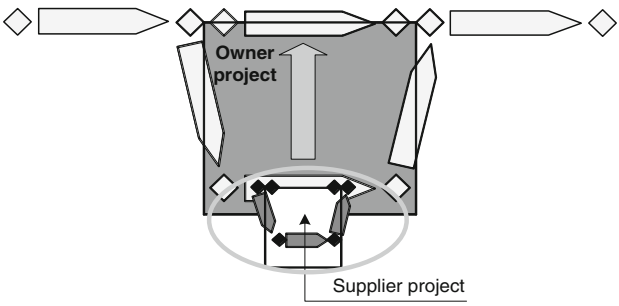

Fig. 11.17 Project value—business focus

An example of a successful offensive navigation concept intervention was discussed in Chap. 4. In this case, a sudden collapse of a concrete gravity base structure jeopardized the company's ability to supply natural gas to France as contracted. The solution to the problem was to design and construct a new riser platform in steel. To be successful, however, the riser platform had to be built twice as fast as normal. In order to achieve this rather extraordinary schedule, the working processes were changed completely and the project manager was given a substantial degree of freedom to do what she thought was appropriate and correct, independent of prevailing engineering and construction practices. As a result, the project team was able to meet the goal of cutting the construction time in half. As a bonus, the construction costs for this steel riser platform came in below the expected costs for the standard riser platform.

The Golden Pipeline (Statoil), Hyde, Andrew and Cleeton projects for British Petroleum [2] are all examples of projects where the application of offensive navigation concepts resulted in major improvements in time and cost. The type and content of the offensive navigation concepts applied were, however, vastly different.

An illustration of the business focus perspective is shown in Fig. 11.17.

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Chapter 12
Allocating Risk at the Contract Level

12.1 Project Contract Perspectives

The project owner has to distinguish between situations where he chooses to do things himself and where he chooses to buy or contract services. This kind of decision is rooted in theories of *institutional economics*, theories of *the firm* [2, 3, 8] and *transaction cost economics* [8]. In these theories, the vital distinction between *hierarchy* (*vertical integration*) and *market* is made. The choice of hierarchy or market is dependent on the transaction costs.

There are a number of different ways in which the market alternative may be implemented. Macneil [6] distinguishes between two types of contracts; *market contracts* and *relational contracts*. Though *partnering* may be considered a type of relational contract, we suggest it is more appropriate to treat partnering as a separate type of contract itself in the context of project management.

Market contracts, relational contracts and partnering contracts represent alternate ways of working with suppliers based on the need for interaction and alignment of interests. For market contracts, the contract document is important in that it is a formal agreement that can be enforced by law. For relational and, in particular, partnering contracts, trust and mutual agreement are fundamental. Commercial issues are vital to all types of contracts. Figure 12.1 illustrates these contract perspectives [4].

12.1.1 Market Contracts

The *market contract* is *transaction oriented*; no relations exist between buyer and seller. The relationship is therefore often referred to as *faceless* as the identity of the buyer and the seller is not important. Further, there is generally no need for interaction between the buyer and seller over the period of the contract beyond award and the delivery of the product or service. Finally, market contracts are

A. Rolstadås et al., *Risk Navigation Strategies for Major Capital Projects*,
Springer Series in Reliability Engineering, DOI: 10.1007/978-0-85729-594-1_12,

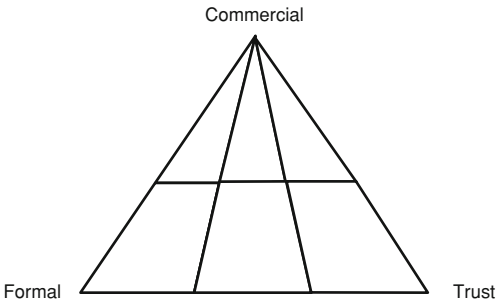

Fig. 12.1 Contract perspectives

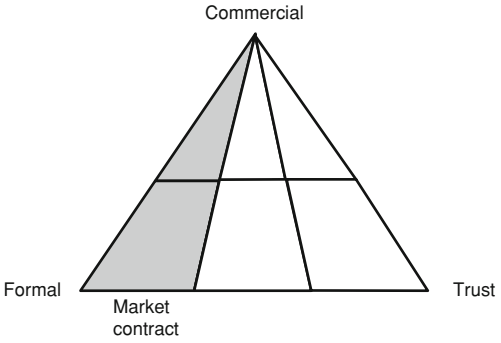

Fig. 12.2 Market contracts

often *discrete* in the sense that they represent a one-off exchange of a product or service. There are no records of prior contracts between buyer and seller and no expectations of future ones.

The positioning of market contract in the contract perspectives diagram is illustrated in Fig. 12.2.

12.1.2 Relational Contracts

A *relational contract* is dominated by an often extensive *interaction* between buyer and seller from contract award to completion. The relationship is referred to as *full face* as the parties view *trust* and *mutual respect* as important features for the contract to be beneficial to both parties. Further, the supplier needs to successfully complete all contract obligations in order to sustain his reputation in the market segment. The concept of relational contracting may be extended to cover a time period, say, three years, rather than a single project. This kind of relational contract is often referred to as a *frame agreement*.

The positioning of the relational contract in the contract perspectives diagram is illustrated in Fig. 12.3.

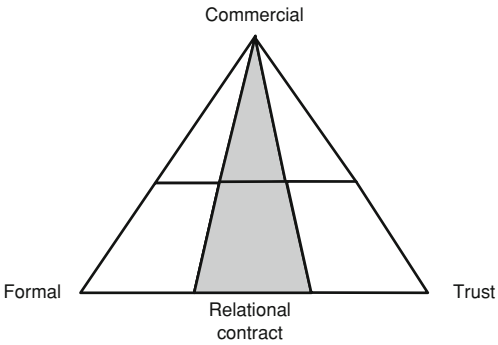

Fig. 12.3 Relational contract

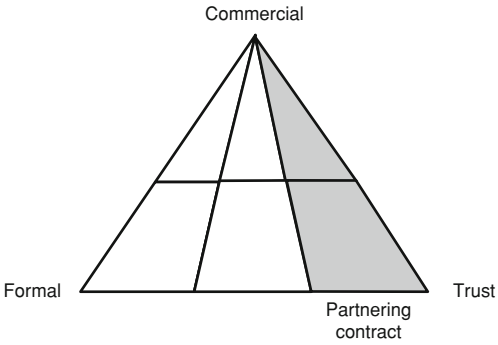

Fig. 12.4 Partnering contract

12.1.3 Partnering Contracts

On some projects two or more contractors enter into an *ad hoc alliance* for a particular project. In an ad hoc alliance, the contractors act collectively to work with the owner. Two contracts are involved: one contract between all contractors in the ad hoc alliance making them *collectively responsible* for the delivery of the product or service and one contract between the ad hoc alliance and the owner. Ad hoc alliances may be formed voluntarily or by force.

Ad hoc alliances may be extended from a single project (first-generation partnering) to a series of projects for one owner (second-generation partnering) and even to encompass the complete supply chain to serve specific categories of owners (third-generation partnering). Bower [1] has defined a comprehensive overview of types of partnering applicable to projects. Finally, the partnering contract may also be used to fully align the interest of the owner and its prime contractors, referred to as a *project alliance* as opposed to a *supplier alliance* [4].

The positioning of the partnering contract in the contract perspectives diagram is illustrated in Fig. 12.4.

12.2 Pricing of Project Contracts

12.2.1 Conventional Pricing Concepts

In contracting theory, a distinction is made between *price-based* and *cost-based* formats. In price-based contracts, a fixed price is agreed between owner and supplier. The general opinion is that the fixed price contract puts the owner in a position where he, in advance, knows what he will have to pay at the end of the project. The risk related to the final costs to provide the goods or service is solely borne by the supplier. Price-based contracts could then be considered a way of eliminating procurement risks viewed from the owner's perspective.

As the cost of bearing the risk remains with the supplier, the supplier will include a *risk premium* in the fixed price offer; hence, the cost of risk bearing is transferred to the owner. If the supplier is better suited than the owner to handle the risks, fixed price bidding is an adequate strategy. Better suited means that the supplier is considered best at acting in ways to reduce and/or mitigate risk by taking actions to minimize damage if risks occur (superior resilient capabilities). If, however, relevant risks have to be absorbed through the establishment of financial buffers, the party with the strongest financial capabilities will be the better suited of the two to handle the risks (superior financial robustness); hence, a fixed price strategy may not be the best solution.

Although the term "lump sum" is often used as a synonym for "fixed price", we have deliberately chosen to differentiate between a contract price that is fixed and the payment method. In a fixed price contract, the supplier may be compensated (receive payment for work done) in a variety of ways:

- *Lump sum payment* (no intermediate payments are made, the whole amount will be paid in one lump at delivery, hence, the notion of lump sum).
- *Milestone payment* (payments are linked to defined stages of physical completion).
- *Progress payment* (payments are made regularly, often on a monthly basis based on reported work performed).

The positioning of conventional pricing concepts in the contract perspectives diagram is illustrated in Fig. 12.5.

Not all price-based contracts are fixed price. *Unit price* contracts and *bill of materials* are considered price-based as the supplier offers a fixed price per unit of quantity. Assuming it is the owner that fixes the quantity of each component to be priced, the contract form is price- and not cost-based. This kind of price-based contract is often referred to as *re-measured* as the final payment is dependent on the amount of physical quantities deployed.

A general opinion is that cost-based contracts should be avoided as there are no incentives for the supplier to work efficiently. Even from a supplier point of view, cost-based contracts should be avoided as lack of focus on efficiency could damage the supplier in the longer run, since their relative working efficiency compared to

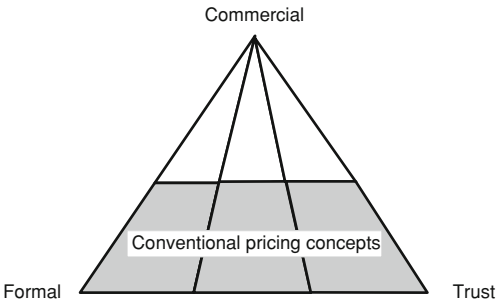

Fig. 12.5 Conventional pricing concept

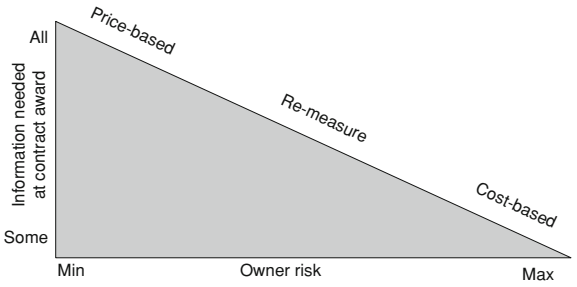

Fig. 12.6 Price-based versus cost-based concepts

competitors may deteriorate. However, there are a number of situations in which cost-based contracting is superior to price-based.

If urgency is important, contract work could be started before work scope is clearly defined. In this case neither the owner nor the supplier knows what the final costs will be. Hence, it is difficult to prepare a good cost estimate at the front end of the project.

The appropriate use of price-based and cost-based contracts is illustrated in Fig. 12.6 [7].

Before turning to incentivized contracts we need to address some controversial issues related to price- and cost-based concepts.

First, the reason for fixed price contracts being considered the best solution is not necessarily that the supplier grants a price that is fixed, but the fact that a number of suppliers compete for the order. The winner is the low bidder. To accommodate a successful fixed price bidding process, the work scope should be defined in a way that is considered closed; either in terms of a detailed description or as a functional requirement. Later changes by the owner may jeopardize the fixed price; hence the project definition should be sufficiently mature before invitation to a fixed price bidding process.

Second, the more unique the contract work and the higher the offered fixed price relative to the revenue of the supplier, the less attractive are the fixed price concepts, as risk premiums rocket sky high. It may come as a surprise that fixed price bidding is better for smaller contracts and for situations where the supplier is quite familiar with the type of work.

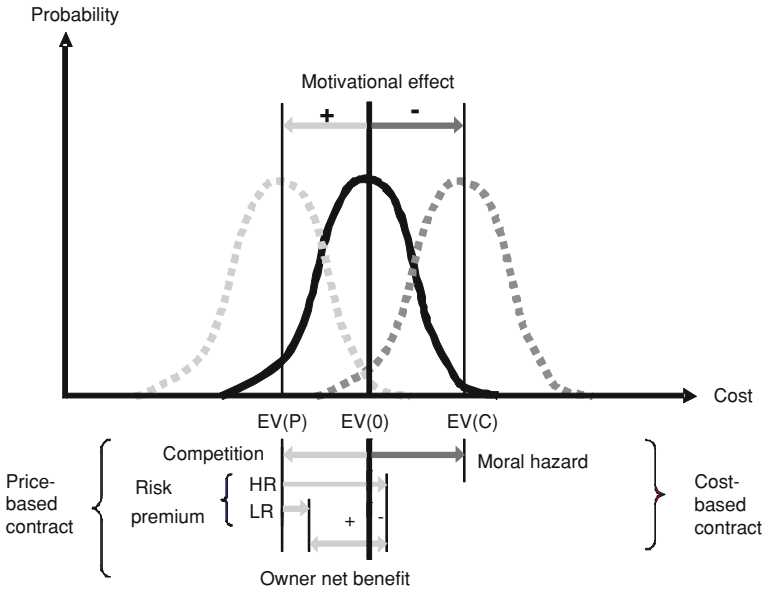

Fig. 12.7 Limitations to price and cost based concepts

Third, contract theorists claim that fixed price contracts contain the strongest performance incentive to the supplier, as savings in production costs will remain with the supplier. Though the latter is true, we will later introduce contract formats that contain stronger incentives than are currently accepted in traditional contract theories.

Fourth, fixed price bidding introduces a situation where suppliers may deliberately underbid to win the contract. In this case, fixed price bidding may increase rather than decrease the risk to the owner. Careful attention to prequalification of bidders and preparation of bid check estimates are measures to reduce the risk of suppliers buying contracts.

Fifth, the choice of pricing concepts matters when it comes to estimating contract costs. Fixed price bidding introduces positive stimuli for the supplier to reduce his costs while a cost-based concept introduces negative stimuli often leading to what is frequently referred to as moral hazard as illustrated in Fig. 12.7 [4].

12.2.2 Incentivized Concepts

From the supplier perspective, a fixed price contract provides an opportunity to enhance his profit by reducing his costs in fulfilling the contract obligations. In this case, the cost to the project owner remains the same.

As the suppliers' profit on a cost-based contract is often given as a percentage of the total costs, the supplier may increase his profit simply by making production costs escalate. This kind of development is in direct conflict with the interest of the project owner.

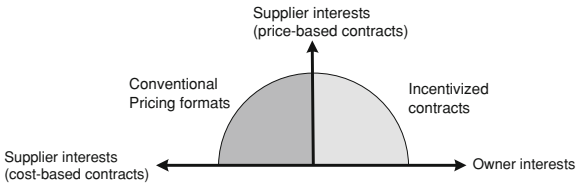

Fig. 12.8 Alignment of owner and supplier interests

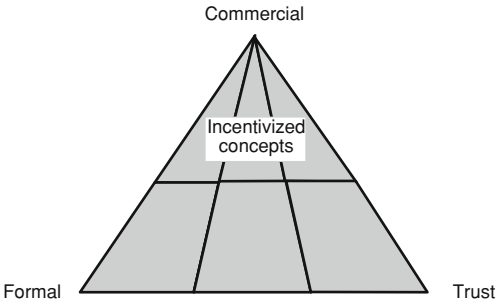

Fig. 12.9 Incentivized concepts

Conventional pricing concepts, ranging from price-based to pure cost-based, consequently are not contributing to an alignment of supplier and owner interests rooted in a gain-sharing mechanism as illustrated in Fig. 12.8.

Pricing concepts that contribute to an alignment of interests, aiming at win–win solutions, are often referred to as *incentivized concepts*. The positioning of the incentivized pricing concepts in the contract perspectives diagram is illustrated in Fig. 12.9. A simple form of incentivized concept, referred to as a target sum concept, is illustrated in Fig. 12.10.

As illustrated in Fig. 12.10, a risk cap is introduced to relieve the contractor of risks that are outside his control, hence reducing the contractor risk premium in the contract price. The risk transferred to the owner is shown down to the right in the figure. Further, up to the left, the figure illustrates how a potential reduction in contract costs is shared between the contractor and the owner. Similarly, a possible increase in actual contract costs is shared the same way. The maximum risk exposure to the contractor is, however, limited by level set for the risk cap. As the contractor's possible loss is vastly reduced compared to traditional fixed price bidding, it is assumed that this will motivate the contractor to proactively act to reduce contract costs rather than act reactively to defend himself against a possible substantial loss.

12.3 Project Contract Management Processes

In this section we give a brief outline of typical project contract management processes. Depending on the project phase we are in, we differentiate between:

- Tendering.
- Contract administration.
- Close out.

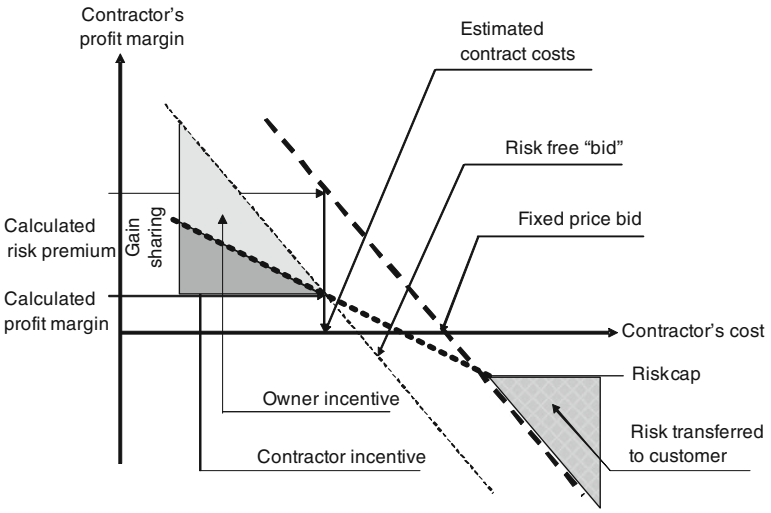

Fig. 12.10 Target sum contract

12.3.1 Tendering

Tendering is a process for supplier selection. A tender is [7]:

An offer to supply or purchase, goods or services

The term 'bid' is often used synonymously with tender, however, contract law links bidding to the process of auctioning i.e. where parties are invited to make competitive offers [7].

The tendering process is positioned in the intersection where the owner and the supplier frame their projects as shown in Fig. 12.11.

In short, the tendering process embraces:

- Identification and prequalification of suppliers
- Invitation to tender
- Evaluation of tenders (or bids in a competitive setting)
- Negotiation or selection of the successful bidder
- Award of contract

The contract documents normally consist of:

- Articles of agreement
- Appendixes

Articles of agreement position the contract as a formal document that could be enforced by law. This is the corner marked *formal* in the contract perspectives

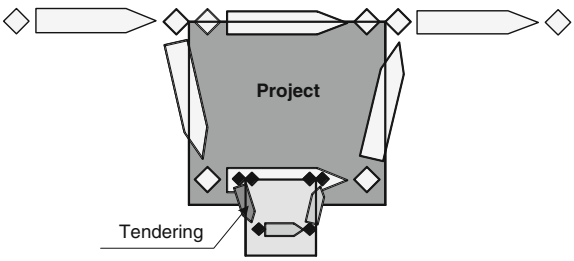

Fig. 12.11 Tendering

diagram (Fig. 12.1). Changes to articles of agreement are referred to as *contract amendments* and legal expertise must be called upon if such changes made.

Appendixes contain the information needed to administer the contract. These are the domain of the project commercial managers of the owner and the supplier. Typically the appendixes embrace:

- Description of the scope of work
- Contract price or principles for pricing contracted work
- Overall master schedule for execution of contracted work
- Company supplied items
- Communication procedures including requirements for reporting of progress
- Miscellaneous requirements depending on the type of contract and the specific situation for the contract

12.3.2 Contract Administration

Contract administration refers to the *interaction* between owner and supplier representatives, often referred to as company representatives. All *formal communication* between owner and supplier from contract award to delivery must occur between the two official representatives of the parties.

The contract administration process is linked to the contract execution process and therefore is positioned within the supplier's framing of the project as seen in Fig. 12.12.

Typical tasks referred to as contract administration include:

- Regular reporting of progress
- Handling of site queries (technical questions that have to answered)
- Reporting of non-conformances (deviations from technical requirements)
- Changes to scope of work (handling of change orders)
- Changes to planned monthly payments (in case of delays)
- Preparation and implementation of corrective actions including acceleration of work processes if required and agreed
- Disputes related to contract conditions

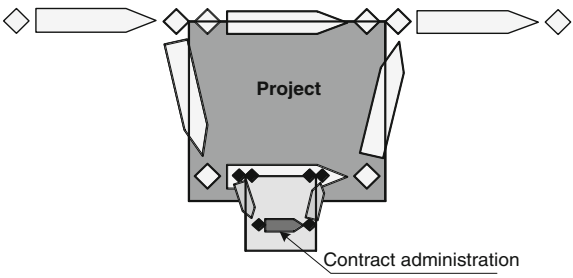

Fig. 12.12 Contract administration

- Changes to contract costs
- Possible extension of time for contract completion
- Miscellaneous contract specific challenges

Disputes between owner and supplier may escalate to arbitration or litigation. Although the project commercial manager may be involved in such processes, this is typically the domain of corporate lawyers, hence outside the domain framed as the owner's and the supplier's project.

12.3.3 Close Out

According to contract law, the completion of a contract is recognized as a single event. This understanding of contracts does, however, not reflect how work on contracts evolves in complex capital projects [7]:

> While construction may cease abruptly, other obligations of the parties may be phased out more slowly reflecting the complexity of verifying completion and contract compliance. A contract does not finally come to an end until the owner, or the owner's agent (the managing contractor or the designer) issues the final completion certificate.

According to Turner [7], completion can take place in several stages:

- Partial completion
- Sectional completion
- Partial possession
- Defects and making good
- The final account

As we have seen, the close out is not a single event but a process, hence represented by an arrow rather than a point in time. Close out is positioned at the intersection of the owner and the supplier's framing of their projects as seen in Fig. 12.13.

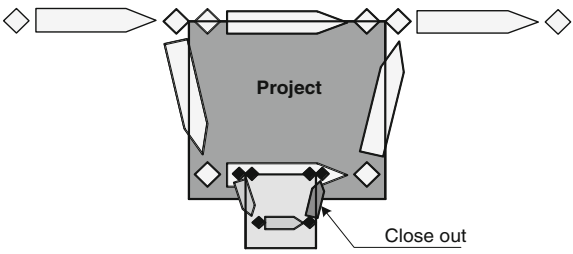

Fig. 12.13 Close out

12.4 Project Risk Allocation

12.4.1 Industry Experience

Almost all contracts have provisions that shift one or more project risks to the contractor. Traditionally, owners have sought protection in the form of disclaimer clauses that make the contractor carry responsibility for delays, changes in site/soil conditions, designs, weather conditions, consequential damages and other variables. Some owners may not realize that contractors, in turn, must protect themselves from project risks in order to remain in business. As a result, they must attach premiums, hidden or explicitly identified, to their bid price. The net result is that project costs become inflated. The costs of transferring risks to the contractors are, in the end, borne by the owner, and often this causes projects to proceed in an atmosphere in which the owner and its contractors are adversaries.

Both of these categories of project costs are real; though the results of the additional expenditures are intangible, i.e., they add no material value to the finished project. Therefore it is desirable to eliminate, or at least reduce, the magnitude of these costs.

The owner is the project initiator, the one who owns all of the risks and determines the nature and scope of the project. The owner as the author of the contract document also has the unique ability to transfer or allocate these risks. There are three options the owner can select to address overall risk allocation:

- Transfer all risks to the contractor
- Share risks
- Contract packaging arrangements

12.4.2 Transfer All Risks to the Contractor

Many owners adopt this option. This option means that the owner *pays the contractor a fixed amount for the work and the contractor is responsible for extra costs if anything goes wrong.*

Table 12.1 Practical guidelines for contract packaging arrangements

Contract packaging arrangement	Advantages	Disadvantages	When Best to Use
Engineering only	Many contractors available Specialization of expertise	Large potential for finding design errors in the construction phase for which the engineering contractor is not accountable	
Engineering and procurement	Many contractors available Engineering contractors specialize in procurement of technical items	Large potential for finding design errors in the construction phase for which the engineering contractor is not accountable	Limited in-house project team personnel
Procurement and construction	Control of equipment deliverables	No accountability for accuracy of drawings and specifications	Only after significant portion of engineering work is completed and reviewed for accuracy and completeness
	Constructability reviews	Limited technical ability for purchase of some equipment	
Construction only	Many contractors available	No accountability for accuracy of drawings and specifications	Only after significant portion of engineering work is completed and reviewed for accuracy and completeness
	More flexibility Can take advantage of various contractors' strengths	Limited and difficult coordination of equipment deliverables	
Engineering, procurement and construction (EPC)	Contractor accountable for all phases of work	Fewer contractors with EPC ability	On large projects (>$100 million US Dollars)
	Ease of coordination of resources (manpower, materials, machinery, and equipment)	Large contingency if price-based Inflexible due to a forced long term relationship with one contractor	After concept selection
	Allows more efficient overlapping of engineering with construction (faster schedule)	Difficult to define and manage cost-based and price-based contracts	
	Everyone familiar with work processes		
	More likely to incorporate constructability reviews seamlessly		

This approach has some legal appeal. However, as a practical matter, based on our extensive experience in construction claims and disputes, things seldom work out this way. The owner will find itself spending time and money dealing with change orders, delays, and disputes, and may eventually end up in arbitration or litigation ultimately, in many cases, paying the contractor more money.

12.4.3 Share Risks

Many risks are best handled by sharing. In allocating risks, the owner should assign risks to the party best able to evaluate, control, manage and bear them. For example, the risk of using a particular construction method is clearly best assigned to the contractor. On the other hand, the risk of issuing faulty, ambiguous or incomplete information and designs are within the owner's control.

12.4.4 Contract Packaging Arrangements

There are many ways of packaging capital projects into contracts ranging from engineering only to engineering, procurement and construction (EPC). All options have advantages and disadvantages and senior managers and project managers must take care in considering and selecting the most suitable option. Table 12.1 provides some practical guidelines for packaging contracts [5].

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Chapter 13
Enhancing the Effectiveness of Project Teams

13.1 Introduction

We have carefully investigated the many practices in project delivery and have concluded that a focus on project alignment and teamwork is a very good approach. This approach is starting to make significant impacts on how organizations are addressing delivery of their capital investments (CAPEX). Specifically, a growing number of organizations are adopting this process as their preferred approach as it has repeatedly demonstrated superior performance on capital projects in many different circumstances and industries.

Teamwork is the ability of a team to accomplish more with higher quality that can be achieved as individuals. Teamwork often means working together on issues while deliberately blurring the formal lines of responsibility.

The objective of the teamwork process is to improve team communication, team alignment and interface management. This ensures that projects are designed and constructed in a coordinated manner to meet the requirements of the owner.

When people work together and leverage complementary individual strengths, the results can be exceptional. This task involves hard work and commitment. The PEO and the project manager must actively facilitate collaboration and establish the conditions for good relationships between joint venture partners and project team members.

We have a wealth of research and practical experience that supports the perception that the quality of project outcomes can be significantly influenced by the quality of the team and the relationships among the team members. Building teams and relationships on projects with many stakeholders with conflicting interests can be a serious challenge. Commitment to building and sustaining strong teams must be made early in the project. It is fundamentally important to pay attention to the team members' interests and concerns and to forge a common understanding and alignment among them. Research shows that individuals who feel a sense of ownership of the project and a commitment to the goals of the team are much more

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likely to "go the extra mile" required to deal with the types of unexpected problems that are likely to occur on complex projects [5].

Effective project teams start, as indicated earlier, with selecting the right project manager and the right team members. The right people do not need to be tightly managed. They will be self-motivated by an inner drive to produce the best results and to be part of creating something great [1].

The first and most important step in building a collaborative team is selecting the right people to work on the project with the right attitude and complementary skills. People and their working relationships are necessary prerequisites for successful joint ventures and projects.

Once the project teams are selected, team members should be co-located so that there is the greatest chance of creating one team, initially at the design office and then at the site during construction and commissioning. This will greatly increase awareness of project progress, improve communication and make it easier to build and maintain team spirit. It is important that team relationships are robust to withstand pressures. Teams must also be willing to confront and resolve relationship issues. This requires a respect for and an understanding of other people's roles and willingness to compromise in the interests of the project [4].

The PEO and project manager set the standards for good relationships and are the role models for others. Managers need to get to know each team member as a person—know what is important to them outside of work and what motivates them at work. By treating each team member with respect, the project manager establishes the right conditions and model for good working relationships. There are many situations that can impede collaboration such as disrespectful treatment, egotism, and non-performing team members. The project manager may need to intervene to stop such behaviors. The PEO and project manager must monitor the team dynamics and decide when to intervene [1].

In addition to getting to know the team members, the project manager should create the environment for the team members to get to know each other by creating opportunities and the right conditions for personal exchanges. Opportunities can be created through planning sessions and games, professional training, everyday interactions, and special events such as celebrating success and milestones. We will explain later in this chapter why formal sessions to build and sustain project teams are needed throughout the project.

13.2 The Project Manager

In today's environment of capital projects, project managers must combine business vision, communication skills, soft management skills and technical savvy with the ability to plan, coordinate, build the team and execute the project. They are not just managers, they are leaders. While this has always been the case, project management must place a higher premium on leadership skills and teamwork than ever before [1].

As discussed in Chap. 7 and illustrated in Fig. 7.5 earlier, the change process, particularly for mindset and behavior, is a journey the project manager and team players must take to become leaders and to create a healthy environment for the team to succeed.

The following characteristics are essential for the individuals who are selected to perform the role of the project manager [4]:

- Technical competence, based on skills, knowledge and relevant experience.
- Decisiveness/willingness to make decisions based on judgment in the absence of facts.
- "Self-starter" who will get on with the job without waiting for instructions.
- "Can do" attitude and willingness to tackle seemingly impossible tasks.
- Flexibility, constrained only by the limits of personnel.
- Ability to forecast the outcome and decide/act accordingly.
- Ability to take the big picture into account.
- Willingness to collaborate and work together to achieve common goals.
- Enthusiasm, relishing the challenge of achieving difficult objectives.
- Strong leadership capability to build team spirit and inspire the project team.
- Managerial competence to ensure essential systems and procedures are followed.
- Openness/willingness to share problems and contribute to solutions.

Desirable project team characteristics that need to be encouraged and nurtured as identified by Eastham [4] include:

- Honesty, openness, trust.
- Anticipation and avoidance of issues rather than waiting for them to turn into problems that have to be solved.
- Mutual support and teamwork for issue resolution, coaching, mentoring and development of members within the team.
- No blame culture. This is essential for decisiveness when information is limited.
- Access to all parties, no communication barriers.
- Lean organization which aids communication and speeds decision making.
- Full-time members, avoiding whenever possible part-time members with other responsibilities and priorities.
- Permanency of membership for the duration of the project.
- Authorized, empowered and enabled team members.
- Accept taking risks so that people will make bolder decisions.
- Decision making delegated to lowest competent level.
- Decision making on the spot, without reference to higher authority.
- Discipline to work to "fit for purpose" rather than customizing and fine tuning.
- Flexibility to use/bend company systems to the benefit of the project.
- Tolerant of team members who think differently/creatively and challenge convention and the obvious.
- No alternate or hidden agendas.

13.3 Aligning the Team

Effective and successful project management of today's major projects is a challenging and complex task. Although success is the goal of all project teams, it is difficult to achieve unless the team is aligned with the goals and objectives of the project.

Organizational success/effectiveness in delivering capital projects is becoming a major challenge in today's project delivery. Literature is flowing with documents and papers about repeated global cost overruns and delays in the project environment [2, 7].

In response to industry's challenges, we are proposing a process for effective team alignment on joint ventures and projects. The process is an evolutionary product of research, best practices and implementation on more than fifty capital engineering projects. The process focuses on developing common goals and objectives and a formal strategy for commitment and communication. The process attempts to create an environment where trust and teamwork foster a collaborative relationship and facilitate the successful completion of the project. It also involves the creation of mechanisms designed to sustain and expand collaboration over the life of the project [5].

The proposed process is a holistic approach to the management of projects, programs and organizational objectives. It offers an accessible and simple approach to management of complex engineering and construction projects. This process requires sound understanding of project complexities and issues to be addressed. It also requires a clear mission for the project and support of the project management team and stakeholders.

Implementing the process typically entails a considerable up-front investment of time and resources to forge a common team identity among participants from different organizations. Depending on the nature of the project and the contract, the number of organizations involved, and their prior experience working together, the process can take many different shapes and forms.

To optimize organizational effectiveness, the process includes elements that exist in some form on any successful project. Differences between success and failure lie not only in the existence of these elements but in their form and application. It is in these latter two areas that the process brings both stark simplicity and higher performance potential [8]. Elements that support organization effectiveness are:

1. *Project chartering and teambuilding*. developed to achieve alignment, issues identification and management, effective front-end planning, improved communication, trust and teamwork.
2. *Tailored training*. to achieve consistency, enhance team effectiveness and better project delivery.
3. *Management coaching*. to provide an independent external view and greater objectivity with a focus on the big picture.

4. *Monitoring team performance*. to provide independent monitoring, to establish an early warning system for potential problems and to provide an independent communications conduit.
5. *Issue resolution and dispute management*. to minimize time and cost losses associated with disputes and to reduce conflict and enhance appropriate communication and other synergies between contracted parties.

13.3.1 Project Chartering and Teambuilding

Project chartering and teambuilding is the center of the delivery process. It is used to achieve stakeholder alignment and bring issues (including hidden agendas) to the table. It is completed when all key stakeholders agree to a plan for successful and achievable delivery of the proposed work. Specifically, the process:

- Sets achievable, yet challenging, goals and objectives for the program as a whole and for individual projects in a program. These goals and objectives must be jointly-developed and mutually agreed-upon.
- Defines specific criteria that will be used to measure the success of the project or joint venture.
- Identifies critical success factors that are essential for achieving goals.
- Identifies risks and accompanying probabilities and develops contingencies and response plans.
- Aligns stakeholders by a combination of expectation management and consensus building.
- Identifies lines of communication and forms the foundation of communication planning.
- Develops project performance evaluation and measurement criteria for monitoring the health of relationships.
- Develops a dispute/issue resolution mechanism for rapid issue resolution which includes the escalation of unresolved issues to the next level of management.
- Agrees on team ground rules which are mutually agreed standards of conduct and behavior.

The benefit of the project charter and teambuilding element comes from the participative interaction of key project stakeholders using an inclusive process to identify and align agendas and expectations.

13.3.2 Tailored Training

Standard training templates can be used to quickly develop tailored training for key team members. In addition, and if appropriate to the project or joint venture, additional high impact training is added for all team members, usually in the form of half-day sessions. When used, these sessions provide essential team member

knowledge of the risk and management processes that enable individuals to contribute more effectively. This training adds to, and is part of the teambuilding process. The training is presented periodically to allow new members of the project team to come on board in a structured way. It reduces loss of time and confusion that otherwise occurs as individuals become acclimatized to the team's norms.

13.3.3 Management Coaching

It is not uncommon to have on-going coaching at the team level. This is sometimes targeted at team behavior, communication, dispute avoidance, issues management or some other identified concern(s). The ongoing coaching may vary in intensity and approach. We recommend a coaching approach based on a drop-in center, or linked to regular team meetings that are attended by a coach to identify issues and then to act on them.

Another approach is to have a coach or team of coaches on call by management. These coaches would be involved as directed by management. However, this is often mixed with other more structured steps that allow the coach a degree of objectivity, so he or she does not necessarily see the project just through the eyes of the management team thus reducing the value of the coaching service. Regular attendance of the coach at progress meetings is a commonly used mechanism, often associated with some sort of de-briefing session.

13.3.4 Monitoring Team Performance

Team performance will be regularly monitored using the mechanism that was jointly developed in advance at the project charter and teambuilding session. The monitoring provides an independent health check of the soft and hard issues on projects and act as an early warning system for potential problems. Most importantly it provides an independent communications conduit between the parties. In order to assure effective implementation, the parties need to agree to a plan for regular performance evaluation to assure that the project is proceeding as intended and that all of the parties are aligned and carrying their share of the load [6]. In a subsequent section of this chapter, we will provide details of the health check approach.

13.3.5 Issue Resolution and Dispute Management

To minimize the losses of time and cost associated with disputes, to reduce conflict and to enhance appropriate communication between contracted parties, we

propose the use of a dispute resolution mechanism also developed in advance at the project charter and teambuilding session. This mechanism focuses on the timely resolution of outstanding issues by negotiation between the parties at the lowest managerial (working) levels. Timely communication and decision making not only saves money but also keeps a problem from growing into a dispute [3]. In a subsequent section of this chapter, we will provide more details of the issue resolution mechanism.

13.4 Monitoring Team Performance

Effective management of team performance and success measurement are difficult because a diverse group of project entities with different backgrounds, interests, and experiences are brought together to work on a project. We have been testing and applying a structured team building process for many years. This is a process for building and sustaining project relationships by aligning project team members to work towards common goals and to commit to creating open and honest communication with no hidden agendas. This process requires establishing a collaborative relationship with a shared value of open and timely communication without regard to traditional organizational boundaries [3, 5].

One important feature of this teambuilding process is the regular monitoring of project performance and success. Project success is first defined and then assessed on a regular basis throughout the life cycle of the project. The project charter includes an explicit definition of success, a consideration of how the various stakeholders will work together and a description of how performance and success will be measured. The authors' work on over 50 projects shows positive outcomes when regular monitoring of success factors is conducted by an external party and incorporated into project progress meetings.

A series of facilitated monitoring sessions or "check-ups" are usually conducted at the end of the scheduled regular project meetings using a tool that was developed at the project charter session. All workshops which are attended by project staff from all parties and levels are intended to break down existing organizational and cultural barriers, to establish and maintain a unified team to achieve the project mandate, and to increase and maintain the level of knowledge with respect to project risks and outstanding issues [3]. The existence of a formal monitoring procedure or tool can enhance the chances of project success because problems and opportunities for completing the project are identified as soon as possible to allow for time to respond.

As discussed earlier, this tool is developed jointly by the team reflecting the needs of the project. The tool may contain specific success criteria such as communications, working relationships, technical requirements and stakeholder and external issues. It acts as a team self-evaluation tool by allowing the team to uncover problems on an ongoing basis and to take corrective actions as necessary. The tool asks each team member to evaluate team performance/success in a number of areas (see Table 13.1 as an example). The questions are framed to be

Table 13.1 Team self-evaluation form for monitoring success

Name:				
Company:				
Date:				
Communication				
1	Communications are…	Difficult	1 2 3 4 5	Open
2	Information flow is…	Restricted	1 2 3 4 5	Free, open
3	Timeliness of information is…	Late	1 2 3 4 5	On-time
Working relationships				
4	Cooperation between parties is…	Poor	1 2 3 4 5	Good
5	Issues and concerns are…	Ignored	1 2 3 4 5	Dealt with quickly
6	Responses to issues become…	Personal	1 2 3 4 5	Project problems
7	Disputes are addressed…	Ineffectively	1 2 3 4 5	Efficiently
8	Problems are resolved by…	Senior management	1 2 3 4 5	Lowest level
Technical requirements				
9	Safety performance is…	Not acceptable	1 2 3 4 5	Acceptable
10	Overall quality is…	Not acceptable	1 2 3 4 5	Acceptable
11	Value for money is	Not acceptable	1 2 3 4 5	Acceptable
Stakeholder and External Issues				
12	Public complaints are…	Frequent	1 2 3 4 5	Infrequent
Please explain and list examples for points 1–12 above that you rated 1 or 2				

both general and project-specific and are based on the success criteria defined by the parties in the project charter. Table 13.1 questions are a modification of a Gray and Larson [5] tool.

The authors recommend the tool be used monthly or bi-monthly near the end of a regular project meeting. Respondents rate each statement on a scale of 1–5. Any response below 2 requires follow-up by the project manager.

All involved parties evaluate their relationships using this monitoring tool. This evaluation provides a forum to identify project-related issues or concerns (flow of information, quality of work, working relationships) so they can be resolved quickly and appropriately. A third party facilitator acts as a catalyst to ensure that issues and concerns introduced in the monitoring tool or identified through subsequent discussions or body language during discussions are adequately addressed by all parties.

In one case study, the data collected for the twelve questions on the *team-self-evaluation form* were averaged for all responses. These are illustrated in Fig. 13.1.

The spider-graph of average responses indicates that both the flow and the timeliness of information (items 2 and 3 in Table 13.1) plus the effectiveness of the problem resolution process and the level to which problems escalate before being resolved (items 7 and 8 in Table 13.1) are shared concerns. Project team responses also show that project safety performance (item 9 in Table 13.1) is excellent.

For comparison with the average of all responses on the team-self evaluation form, averages by organization were plotted for the engineer, the owner, and the contractor (see Fig. 13.2). The comparison shows a high degree of consistency and

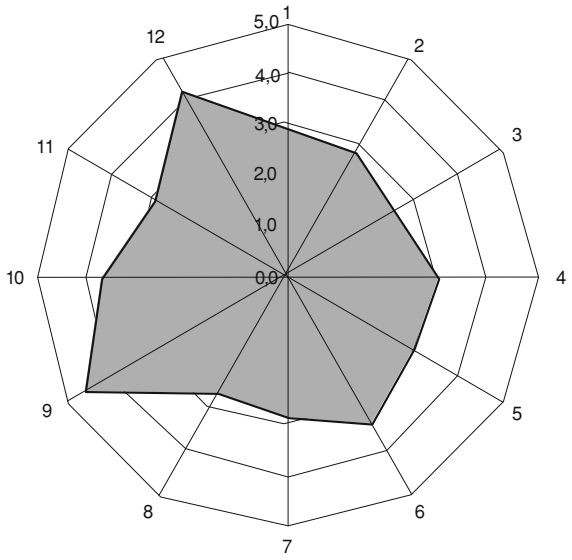

Fig. 13.1 Average of all responses

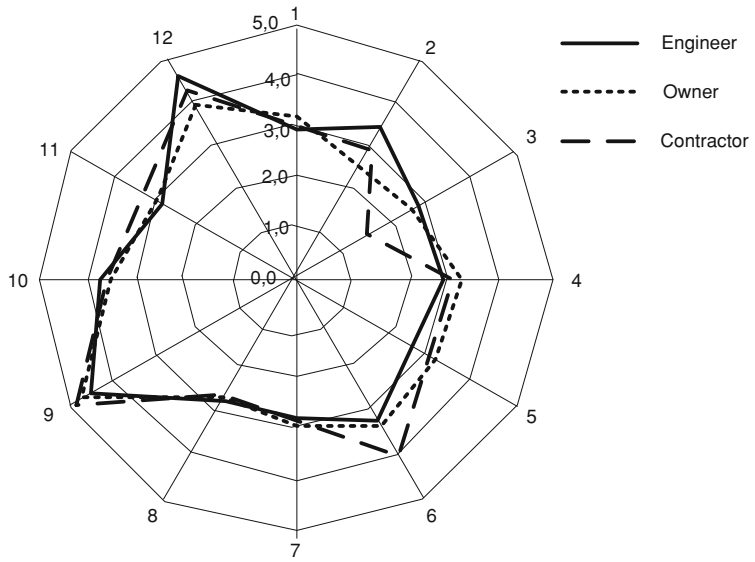

Fig. 13.2 Average response by organization

alignment of most responses except for the flow and timeliness of information (items 2 and 3 in Table 13.1) and whether responses to problems became personal issues or were considered as project problems (item 6 in Table 13.1).

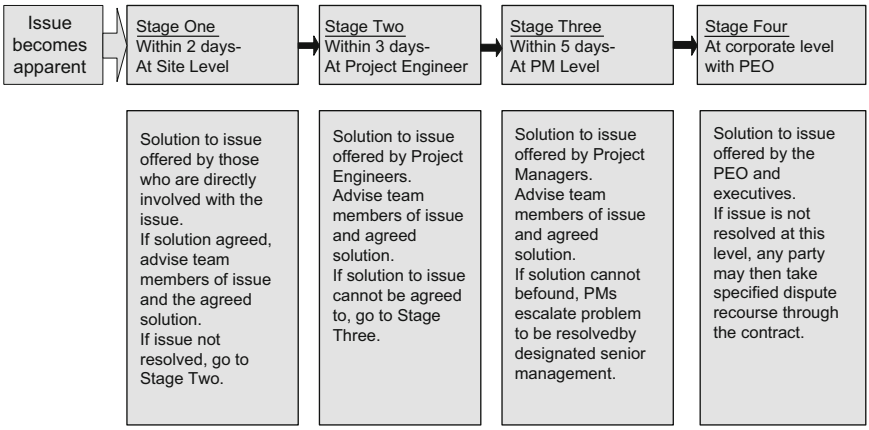

Fig. 13.3 Issue resolution and dispute management mechanism

13.5 Issue Resolution and Dispute Management Mechanism

The issue resolution and dispute management mechanism is based on the concept of escalation which means that issues have to be resolved at the lowest working managerial level within a set time limit or they are escalated to the next level of management. This mechanism is meant to provide a conduit for negotiation and resolution in a timely and fair way. However, if the parties at one level cannot reach agreement, they should not hesitate to escalate the problem to the next level so that their relationship will not suffer over an unresolved issue. Moreover, disputes are not to be taken personally.

Project managers must give authority to lower levels to resolve issues. Senior managers and senior staff should not overturn these agreements at a later date. The flowchart in Fig. 13.3 represents a typical jointly developed mechanism [3].

13.6 Independent Facilitation

An independent facilitator from the PEO office, working closely with the project team as a teambuilding advisor, is essential to the success of this process. The facilitator's main focus is on promoting and maintaining the health of relationships during the life of the project. The facilitator administers the project self-evaluation (health check) tool and fosters an environment based on respect, trust, and fairness that promotes honest, open communication among all parties. The value of engaging an independent facilitator in this process is that he or she can act independently from any obligation to individual parties. In effect, the independent facilitator's interest is vested only in the success of the project team, and, therefore, the success of the project.

13.7 Verification

This process has been tested on over fifty engineering and construction projects including light rail systems, highway interchanges, airport construction, roads and bridges, high rise buildings, hospitals and mega oil and gas facilities [8]. Based on this testing, we established that the process helps project teams achieve their objectives by:

- Getting the key people together with a mindset that is aligned and focused.
- Defining common goals and objectives and developing plans to achieve them.
- Discussing the nature of adversarial relationships, why they are counterproductive and how they can be avoided.
- Encouraging open and honest communication that fosters trust.

Industry testing of this process also showed the following key benefits can be achieved:

- Better alignment of goals across the project team.
- Improved communication between all parties.
- Better planning and commitment to timelines, yielding better results.
- More buy-in by everyone in the project to achieve the goals of the organization.
- More satisfied stakeholders.
- A better chance of resolving differences and disputes.
- Better risk navigation (anticipation, planning and response).

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Part III
Summary

In Part I we argued that new thinking is required concerning management of risk in major capital projects. We have developed a new approach that was presented in detail in Part II. In Part III we have given selected examples on risk navigation tactics. We have focused on reshaping the governance system.

In Chap. 11 we took a thorough look at project execution strategies. We defined four different concepts:

- Definitive navigation concepts
- Defensive navigation concepts
- Adaptive navigation concepts
- Offensive navigation concepts

We discussed project business value with a production, operation and business focus.

Chapter 12 was devoted to how risk is allocated at the contract level. Different contract perspectives were discussed along with different pricing concepts. The contract management process was explained and risk allocation was discussed. Three options were identified:

- Transfer all risks to the contractor
- Share risks
- Contract packaging arrangements

In Chap. 13 we discussed another important aspect of project performance: the effectiveness of project teams. We proposed a new framework to optimize team (and organizational) performance. The main elements are:

- Project chartering and teambuilding
- Tailored training
- Management coaching
- Monitoring team performance
- Issue resolution and dispute management

A four step implementation process was explained and we have shown how success can be measured based on team performance. The results of a survey conducted in a recent research project were presented.

Chapter 14
Closing Remarks

14.1 The Earth is Still Flat

This book began with the authors challenging the notion that projects are inherently predictable and that it is therefore a reasonable management goal to insist that project leaders and teams demonstrate predictable outcomes. We note that the history of major capital projects, in every category, demonstrates that this is a false hypothesis; in fact, the nature of major capital projects creates a foundation for significant unpredictability.

Rather than suggest that this shattered illusion represents an unpleasant truth within which managers must live, we suggest that the reality of unpredictability presents great opportunities for capital-intensive organizations to take traditional project management to the next level. By letting go of the traditional, closed way of thinking about projects and embracing the degrees of freedom that are required for managing uncertainty, the business value that capital investments can create is greatly increased.

Anyone who has been schooled in and practiced traditional project management and risk-management techniques knows the commandments: "Define the scope and don't change it!" "Plan the work and work the plan!" "Set the goal and do whatever it takes to achieve it!" These commandments are great ideas for projects of short duration and limited scope. But for major capital projects, spanning many years and facing many uncertainties that go beyond a project team's ability to control, we have proposed the counter-intuitive notion that leaders should be *adaptive*; willing to change the scope, adjust the plan, and even change the goals in order to increase the business value of the asset they are creating.

In order to implement this new adaptive approach, we have described new methods to think about planning, decision-making, risk management, the owner-contractor-supplier "eco-system", and the management of project organizations. Far from being theoretical, these methods are drawn from the experiences of numerous projects and organizations which, when faced with significant

A. Rolstadås et al., *Risk Navigation Strategies for Major Capital Projects*,
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challenges, recognized the need for fresh thinking and, as a result, achieved extraordinary results.

14.2 Per Willy: The Slow Learner

On a rainy day in April 1977 I checked in at a first class mountain hotel in Norway. Being a newly appointed junior executive for a major Norwegian contractor I was sent to my first training program in leadership. The audience, a group of executives from industry, was far senior to me. The training program was presented by a prestigious school of management. The course instructor was a senior foreign researcher who recently had finished a comprehensive study of major international companies struggling to adapt to a changing global market. Results from the study were conceptualized to reach a greater audience than the organizations studied.

The prime concept, *the enterprise as a structural element*, presented by the instructor was radically different to what was traditionally found in text books on organization and leadership. The organization's image was highly dynamic and evolutionary, illustrated by a number of circles and connections, a representation of what later came to be known as a loosely-coupled structure. The effect on the audience of executives was astonishing. Midway through the instructor's second hour of presentation, the executives said stop and demanded a time-out. They had not travelled to this remote site to listen to such nonsense. A kind of mutiny then occurred and the executives took control of the program themselves.

The executives then prepared a modified program commencing after lunch the first day. Each executive was offered half an hour to present his/her own views on organization and leadership, a kind of best practice 1976. The course instructor was degraded to a course participant that needed to be enlightened on how things worked in the real world.

In my half hour I presented my prime challenge that I phrased as *winning the North Sea battle*. As manager of planning and business development I was to establish a loosely-coupled structure of cooperating suppliers in Norway and the UK, a kind of a temporary non-equity based alliance of suppliers eager to get their share of contracts to develop an infrastructure of platforms and pipelines for production and transportation of oil and gas. My illustration of this challenge took form as a number of squares and connecting lines, of which some dotted, representing a complex structure, significantly different to the conventional hierarchies presented by my executive colleagues at the training program.

The course instructor looked at my diagram and nodded approvingly; saying that this was precisely what he was trying to say in his opening presentation. I looked at him, puzzled, not understanding what he meant at the time.

Eighteen years later, as I was finishing my PhD thesis, I happened to see my illustration together with the diagram presented by the course instructor at the 1977 training program. Surprisingly, the illustrations looked the same. The main difference was that I had used squares, the instructor had used circles. Suddenly

I came to understand what the instructor had presented—an abstraction of my own world of reality in 1977. I recognized myself to be a slow learner. It had taken me 20 years to understand an illustration that had presented a completely new concept. I sincerely hope that executives of today are not slow learners that will take 20 years to grasp the message of the many new concepts presented in this book. To break away from a slow learner mentality, we suggest you read Chap. 8 on the need for shifts in mindset before reading the rest of the book.

Perhaps the most important and final point we would make is this: Project leaders and teams select the difficult line of work known as project management because they love a challenge and are confident that their creativity and resourcefulness will always allow them to prevail. The open, flexible, and adaptive style of project management and risk-management we propose and the concepts we present are, above all, ways to let project leaders and teams do what they do best—provide organizations with the best possible outcome for their major capital projects.

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