

Sponsored Research Program

EXECUTIVE SUMMARY:

Complexity

July 2013

SUMMARY

PUBLISHED RESEARCH

The following abstracts are the executive summaries of, or introductions to, the published monograph. Full texts are available for free download by PMI members or for purchase at the Marketplace. Texts currently in the publication queue or those that more indirectly address complexity are not included.

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Project Portfolios in Dynamic Environments: Organizing for Uncertainty (2012)

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Project portfolio management (PPM) refers to a set of processes and practices used to manage a group of projects and programs to achieve strategic business objectives. The focus of PPM until now has been on project selection and prioritization and on the strategic alignment of projects. The current literature on project portfolio management makes little mention of potential disturbances to project portfolios, such as new, terminated and delayed projects; incorrect planning due to high uncertainty; and changes in the external environment. This is somewhat surprising considering that management in the face of uncertainty has been studied for a number of years in the fields of change management of single projects, organization theory, and strategy theory.

This research investigates the following question: How is uncertainty affecting project portfolios managed in dynamic environments? An uncertainty management perspective is adopted instead of the more established practice risk management.

While different approaches have been developed in the context of the management of single projects, these ideas have not been carried over to the management of project portfolios. It is unclear whether these approaches are applicable at the portfolio level or whether it is sufficient to incorporate flexibility at the project level to gain flexibility at the portfolio level.

The dynamic capabilities framework is used to examine the management of project portfolios in dynamic environments. According to the concept of dynamic capabilities, resources and capabilities must be constantly reallocated and re-optimized to adapt to changing environments. Only a few such capabilities have been investigated empirically, and unfortunately, there are very few descriptions of how firms can implement and maintain dynamic capabilities in practice. The conceptual framework for this research was initially composed of three main concepts: sensing, seizing, and reconfiguring/ transforming. During the classification of the different mechanisms observed in four portfolios, it became clear that there were at least two orders of changes occurring in the organizations and that it would be useful to distinguish and treat these two concepts separately.

The research is based on four portfolios in two firms using retrospective analysis. Sufficient material was collected and analyzed to: (1) provide a better understanding of the management of project portfolios, more specifically of the operational activities involved once portfolios are selected and authorized; (2) analyze the relationships between the sources of uncertainty in dynamic environments and the mechanisms put in place by organizations to minimize their impact and to capitalize on opportunities; (3) develop ways to operationalize the concepts in the dynamic capabilities framework; and (4) suggest improvements to the dynamic capabilities framework.

Increasing Project Flexibility: The Response Capacity of Complex Projects (2011)

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Prescriptions for front-end structuring of complex projects focus on the identification of major uncertainties and on the measures that could mitigate the ensuing risks. However, many events and circumstances that affect a project over its life cycle cannot be anticipated early on. Failure is often due to the inability to adapt to changing circumstances. The results reported here indicate the importance of the planning stage in a project's success, in light of the probability of unexpected occurrences.

The response capacity of complex projects first came to the attention of project management scholars in the 1980s, with the surge of an economics-inspired practice of allocating risk among project participants. Turnkey contracts, build-operate-transfer (BOT) arrangements, and more recently public-private partnerships (PPP) were promoted as panaceas to cost overruns, financial shortages, and inefficient exploitation. But many such projects failed, mainly because the contractual structure put in place for dealing with anticipated uncertainties and risks constrained participants' responses to unexpected events.

This research addressed that issue by focusing on projects as temporary organizations. Despite their temporary nature, complex projects can acquire enough clout to shape the subsequent decisions and actions of project participants. This research explored: (a) the processes that instill in these organizations such powerful properties and how they are influenced by the decisions made during planning; and (b) how their specific properties enable or constrain responses to unforeseen circumstances, and how they condition the success of a project.

In this study, the move away from decision-theoretical frameworks toward organizational process parallels the evolution of the field of business strategy, which turned its attention from outwardly oriented decision frameworks to organizational processes that occur within firms. Strategy is now conceptualized primarily as nurturing organizational capabilities, such as routines and competencies, and, more recently, innovative and dynamic capabilities, which give firms a competitive advantage and the ability to sustain it by adapting to changes in the environment. Due to the special nature of complex projects, this monograph provides useful insights for understanding strategizing in permanent organizations.

The research was conducted in three stages, yielding theoretical and empirical results. The first centered on the development of a theoretical framework and the elaboration of a series of preliminary hypotheses. The second stage consisted of 17 case studies of complex projects, and the third was a survey of 71 recently completed complex projects.

Chapter 1 underscores the importance of response capacity and places it in the context of project management research. The concept stresses an organizational structure that emerges during project execution. The chapter outlines the development of a process model that includes three project stages (planning, execution, and exploitation) and two connecting processes (organizational structuring and reaction to unexpected events), which are depicted as deviating from planners' intents. Deviations occur because planners overlook some aspects, find others more intricate than expected, or discern others of which they were only marginally aware. Because of these emerging and concealed aspects, the resulting structure shapes the reaction to unexpected events in ways that are unintended and sometimes incomprehensible. In turn, reaction processes affect the likelihood and success of project exploitation.

Chapter 2 presents a series of dimensions that characterize project planning, the emergent structure of the project and its success, as well as the structuring and reaction processes. The literature was reviewed to identify key dimensions of planning that are most likely to influence the project's emerging structure: the nature of knowledge used in the planning process, the number and importance of participants in the planning process, the nature of the arguments advanced in the

plan documents, and the basic approach for addressing risk adopted in the plan. The authors characterize the extremes of each dimension and suggest how they likely influence the subsequent structuring processes. Prior research on complex projects is referenced to identify properties of the emergent project structure that comprise the project's response capacity, namely: cohesion, flexibility, and resourcefulness. The authors view each property as having two dimensions and, similar to the case of planning, theorize their extremes and the way they condition the reaction to unexpected events.

Chapter 3 presents the results of the 17 retrospective field studies of complex projects in North America and Europe, purposefully selected from three types of sectors: discovery, digital, and infrastructure. It also includes analyses related to the planning, response capacity, and performance variables as well as to the two processes included in the theoretical framework. The authors show how the qualitative phase led to a better understanding of the mechanisms at work in complex projects, and lent methodological rigor to the study. The chapter concludes with a comparative analysis of the influence trajectories among planning, response capacity, and performance based on an intra-case assessment of variables.

Chapter 4 presents the results of a quantitative survey of 71 project leaders and managers closely involved in complex projects around the world. The subsequent section shows results relative to each variable—their reliability and the relation between survey items and the composite measures, as well as the relations between variables referring to the same construct. The subsequent section presents mainly two types of analyses to detect the role of response capacity in the influence trajectories from planning to project performance.

The final chapter revisits the theoretical and empirical results in order to underscore the most important conclusions for project management research.

Aspects of Complexity: Managing Projects in a Complex World (2011)

Terry Cooke-Davies, (Editor-in-Chief);

Lynn Crawford, John R. Patton, Chris Stevens, and Terry Williams (Contributing Editors)

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This monograph is based on a series of PMI Research Open Working Sessions (ROWS) conducted in 2007–2008 in response to the emerging problem of project complexity. A panel of six presenters addressed the twin-pronged topic of "complexity in project management and the management of complex projects" in four sessions in Atlanta, Sydney, Malta, and São Paulo and it is out of these sessions that this monograph came to be. The book is directed toward three audiences: people who manage programs and projects (practitioners), line managers in organizations to which programs and projects make a substantial contribution (managers), and members of the academic research community who have an interest in how complexity shapes and influences the practice of program and project management (researchers).

Part I is directed primarily toward the practice community, although Chapter 1 contains an overview of the entire field. It focuses on managing complexity from various and intertwined perspectives of strategy, senior managers, and project managers. Tools for managing complex projects and training for operating in a complex and uncertain environment are also discussed. Part II largely addresses the research community, presenting a soundly argued review of potential research fields relating to complexity that could provide useful insights into the management of projects.

Chapter 1: Complexity in Project Management and the Management of Complex Projects

Terry Cooke-Davies

Summarizes the topics on complexity presented in the book from a series of dialogues between practitioners, managers, and researchers from PMI Research Open Working Sessions in 2007–2008.

Chapter 2: Managing Projects with High Complexity

Stephen Hayes and Daniel Bennett

Examines the findings from the 2009 ICCPM roundtable series on the issues that impact the success of complex projects and considers the implications for program managers, both from public and private sector perspectives.

Chapter 3: Tools for Complex Projects

Kaye Remington and Julien Pollack

Discusses tools, techniques, methodology, and theory and how they have been used in the authors' research to address complex projects and their applications.

Chapter 4: Strategic Management: Developing Policies and Strategies

Christoph Loch and Frederick C. Payne

Addresses how strategy may be applied to complex projects, determining the complexity of a project, tools to use in complex projects, and the strategies to choose when addressing complex organizational activities.

Chapter 5: Fear of Flying

Stephen Carver and Harvey Maylor

Examines the challenges faced and the role of complexity in PPPM, given the probable outcome of failure in one or more aspects of the project.

Chapter 6: The Impact of Complexity on Project Cost and Schedule Estimates

Dale Shermon

Describes how parametrics can be used in initial assessments, and creating realistic and accurate budgets for complex projects.

Chapter 7: Beyond Competence: Developing Managers of Complex Projects

Lynn Crawford and Ed Hoffman

Examines the definition of competence and the standards for assessing it in the management of complex projects, the role of experiential learning, and how employers may best provide this.

Chapter 8: Human Behavior and Complexity

Terry Cooke-Davies

A review of research on some prominent aspects of human behavior, judgment, and decision making.

Chapter 9: Controlling Chaos? The Value and the Challenges of Applying Complexity Theory to Project Management

Kaye Remington and Roxanne Zolin

How “chaos theory” and “complexity theory” apply to the management of projects, and the conceptual challenges that they present to both researchers and practitioners.

Chapter 10: Systems Thinking and the Systems Movement

Peter Checkland and Terry Williams

Summarizes the development of natural and artificial systems, with a focus on soft systems methodology and system dynamics, each of which provides a different window into the causes of project complexity.

Chapter 11: Systems Engineering and Project Management

Andrew Daw

Highlights the respective contributions made by systems engineers and project managers to the challenges of complex projects that attempt to provide solutions to “wicked” problems.

Chapter 12: Toward a Coherent Research Agenda

Terry Williams

Written primarily for academics, this chapter identifies new avenues for research to advance understanding of complex projects.

Chapter 13: Toward Project Management 2.0

Terry Cooke-Davies

Geared toward the practitioner community, the chapter summarizes the topics and issues presented earlier.

Early Warning Signs in Complex Projects (2010)

Ole Jonny Klakegg, Terry Williams, Derek Walker, Bjørn Andersen, and Ole Morten Magnussen

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Projects comprise many processes and tasks that transform initial decisions and assumptions into specifications: how resources are allocated, solutions developed, and the necessary elements acquired and implemented. Contracts and communication processes, among other things, bind the entire enterprise together, making progress and goal-oriented coordinated performance possible. Projects are specifically arranged to make this happen.

Worldwide, project managers and their teams strive to improve their planning and executing capability, which improves the chance of executing projects well. On the other hand, they experience increasing frequency of change, confusing objectives, an expanding number of stakeholders, and increasing urgency. Complexity seems to increase in terms of the technological solutions, the human interactions, and the uncertainty everyone has to face. It is not much easier for the project owners—they tend to lag behind in their strategic thinking and they face challenges in all directions. This has been exemplified by the global financial crisis and the need for long-term sustainable solutions to severe environmental and social development.

While there has been increasing professionalization, empowerment, and control activity connected with projects, a significant challenge remains, namely, that sponsors and project managers still often fail to see problems before it is too late. How can early warning signs be identified and acted upon, so that problems are avoided before they develop, allowing projects to be successful in delivering the expected value for their owners and other stakeholders?

The research reported here addresses this question drawn from four sources of data: (1) what the literature reports about the problem; (2) how governance frameworks and their written guidelines prescribe solutions to this matter; (3) how interviews with project assessment experts provide access to practical experience; and (4) how case studies supply empirical evidence through examples and deeper analysis. Each source of data produces a list of potentially valuable early warning signs to which project managers should be alert. The research team was composed of scholars from three countries who studied guidelines and cases from Australia, Norway, and the United Kingdom.

The literature confirms that the challenge in recognizing early warning signs revolves around our limited ability to (1) understand the risks and uncertainty connected to projects; (2) comprehend complexity and see through it; and (3) detect tacit knowledge and understand how people respond and interact.

Evaluating proposed solutions—expressed as guidelines to project assessments embedded in governance frameworks in private and public organizations—authors concluded that there are many different methodologies for assessments, depending on the nature of the problem and the intended use of results. Reviews, audits, health checks, benchmarking, and post-project evaluations all have different methods for analyzing and extracting indications of past, present, and future performance. Choosing the right method and focusing on a relevant indicator will certainly help. However, experts' experiences from a wide range of project types in all sectors over a long period of time confirm that these formal approaches to project assessments are still limited, in that they are good at finding what they are looking for, but not for finding anything else. They also point to the need to look for less well-defined indicators.

Study results encourage project managers to accept the validity and use of a more subjective—"gut feeling"—approach to understanding a project and its environment, which frees the project manager from becoming preoccupied with what he or she wants or is prepared or trained to look for. Respondents observed that project managers often do have a sense of uneasiness about situations or actions that later cause problems, although they may not express concerns, and, thus, warnings are not heeded. "There are many lessons identified, but not many learned" according to one respondent in the study.

The case studies illustrate this in very practical terms. They show that project assessments of many kinds are actually used and provide signals that may be acted upon, or reassurance that a project is on course. More often, only moderately complex projects succeed in avoiding problems by use of formal analysis and review. Highly complex projects need more than formal assessments to succeed in identifying the issues that may develop into problems later in the project. This study reports on eight cases in various settings, illustrating how some project members reacted, whereas others did not, to subjective signals, which eventually evolved into objective problems. Four cases are summarized; four others are described in rich detail.

At the close of the report the authors discuss the research questions about early warning signs in complex projects, and revisit the early warning signs identified through the four data sources outlined above.

Exploring the Complexity of Projects: Implications of Complexity Theory for Project Management Practice (2009)

Svetlana Cicmil, Terry Cooke-Davies, Lynn Crawford, and Kurt Richardson
University of the West of England, UK

In this monograph the authors discuss the implications of complexity theory for project management theory and practice. This study contributes to, the pertinent and lively discussion about complexity in and of projects which, in part, emerged in response to the growing concern about the dominance of various versions of control theory, operations research, systems theory, and instrumentalism in the studies of projects, project management, and project settings in general. A growing body of critiques, propositions, and research trajectories has exposed deficiencies and controversies associated with the relevance of traditional project management research to the challenges experienced in contemporary project environments and with its practical application at three levels: (1) discrepancy between "project management best practice" recommendations and what is really being enacted in practice; (2) observations of paradoxical, unintended consequences in practice that emerge from following the project management prescriptions in "the book"; and (3) the need for alternative theoretical conceptualizations and thinking about projects and project complexity in practice.

A common observation of both practitioners and academics is that the body of knowledge related to project management relies heavily on the traditional concept of the project life cycle (PLC) and is driven by the pursuit of universal best practice prescriptions, which could be easily commoditized, packaged, and efficiently disseminated by means of training courses, handbooks, good practice standards, or online-based tutorials. Consequently, mainstream project management textbooks, manuals, and in-house project management procedures are increasingly seen by both researchers and organizational members enacting “project management” in their daily practice, as inadequately addressing the complexity of projects in a theoretically sound and practically relevant way.

Examples of work that have illuminated and criticized the prevailing normative and prescriptive character of the project management knowledge system and suggested alternative perspectives for studying and understanding projects are numerous and growing. Attention should also be drawn to a growing body of literature linking innovation and technological advancements across industrial sectors with challenging project environments in which the resulting complex products and systems are being designed, developed, and produced. The observations generated by documenting the management processes and capabilities in innovation-charged project settings add a valuable dimension to our understanding of challenges in contemporary project management practice and encourage further study of project complexity and how to cope with it.

The authors note that the labels “complexity” and “complex” have become an almost unavoidable part of the contemporary project management jargon and inevitable in expressing and explaining the nature of problems and challenges people experience in project environments. We have almost reached the point where we rarely question what we mean, by these words or by the notion of “project complexity.” The more these phrases become part of the everyday project management language, the less attention is paid to what they stand for both theoretically and pragmatically. We are witnessing a spread of standards regulating the definition of, approach to, and evaluation and skills development of “complex project managers,” again raising the concern about a theoretical commodification of social practice (that is, project practice) into a set of universal definitions and procedures.