Chapter 2

Managing Projects With High Complexity

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Introduction

During 2009, the International Centre for Complex Project Management (ICCPM) hosted its first international roundtable series on complex project management in the United States and Australia. The roundtable series was titled "The Conspiracy of Optimism—Why Mega Projects Fail." The *conspiracy of optimism* is a term used in areas as diverse as economics, environmental change, and complex project management. It describes a situation where a number of stakeholders, each with their own priorities and unique worldviews, tacitly ignore the reality of a situation in order to gain approval to proceed with a venture no one would sanction if the true outcome was known. The roundtable series provided the opportunity for senior government and industry officials from Australia, the United Kingdom, the United States, and Canada to analyze the issue, reach consensus on some of the drivers, and propose a future course of action. A position paper and findings paper have subsequently been written and an international task force has been established to help improve the international community's knowledge and ability to better deliver complex projects.

This chapter examines the findings from the 2009 roundtable series and considers the implications for program managers when dealing with complex projects, both from a public and private sector perspective. How does the presence of a high degree of complexity influence the behavior and practice of a project manager? What does it feel like to be a program manager in a complex project? From an existing good practice perspective what has been found to work or not to work? What are the key elements that help or hinder a program manager? How does a project manager influence his or her environment to better manage the affects of complexity?

Complexity

In situating this chapter, it is also necessary to frame what makes a project complex while noting the contextualization of complexity ultimately depends on an individual or organizational "lens." In 2007, the ICCPM led an international meeting that described complex projects as those that:

- can be characterized by uncertainty, ambiguity, with emergent dynamic interfaces, influenced by significant political or external changes;

- run over a period which exceeds the product life cycles of the technologies involved or where significant integration issues exist;
- defined by effect (benefit and value) but not by solution (product) at inception.

Key Issues as Highlighted by ICCPM Roundtables

The following paragraphs highlight a range of issues that complex project management practitioners, from both the public and private sectors, believe have a significant impact on the success of complex projects.

Unaccommodated or misaligned stakeholder views of success. The view of success is driven by divergent stakeholder expectations of project success that is derived by assuming each other's interests to be aligned. As the number of stakeholders increase, there is an increase in risk associated with attributes such as outcome, control, ownership, and schedule.

Tension between product success and project success. The tension arises from, and encompasses the clash of paradigms associated with stakeholder interests—private versus public, product versus project outcome. The purchase of a new defense capability, such as an airborne early warning aircraft (product), without consideration for its role in a much larger network-centric environment (outcome) is a useful example.

Political and public relations pressure militating against doing the right thing. How often do we fail to see the timely cancellation of multibillion dollar projects due to the implications for political and corporate image? To resist pressures of this kind, and to improve timely/difficult decision making, requires clear situational awareness and a comprehensive understanding of the facts coupled with personal and organizational courage supported by effective senior leadership.

Lack of understanding or acknowledgment of nontechnical risk. Traditional or classical project management focuses on hard system theories such as systems engineering that fully account for technical aspects of project risks. However, complex projects need to be viewed as organic systems of systems and should include soft systems issues such as politics and more often than not a significant number of external stakeholders. Consider planning risks (and opportunities) associated with the global financial crisis. Few of these relate to technical risk and, as with the potential policy changes and implications following a change of government, result in the need for a paradigm shift for many programs in the approach to understanding and managing risk.

Use of competition as a weapon. Competition within an open environment promotes effective and efficient use of resources. However, within monopsonistic environments, the use of artificially created competition has the potential to drive a misperception of competition, resulting in relative ineffective and inefficient outcomes such as driving the contract price below an achievable level. This is analogous to perceived economic free markets that employ the use of tariffs to enable artificial competition. In a monopsonistic environment, both the customer and supplier have a responsibility to ensure they have a rational understanding of the real cost for capability through the implementation of systems to de-risk cost uncertainty.

Institutionalized procurement practices. Classical project management responds well to institutionalization of procurement practices and standardized methodologies. Within complex project environments, adhering to rigid procurement processes and procedures can limit the agility and ability of an organization to respond to complexity and therefore avoid the realization of unknown risk.

Few project managers are equipped to be project delivery leaders. It is becoming sufficiently evident that a project manager's skill base needs to be multidisciplinary, encompassing source knowledge from discrete disciplines such as law, economics, engineering, and human resources. In the future, managers of complex projects need to be developed and selected based on a range of leadership skills that enables them to operate in uncertain and ambiguous environments. With globalization and greater complexity, we are increasingly moving into an environment of globally interconnected organizations focused on strategic benefits realization. In this environment where outcomes are being managed using both operations and projects, project delivery leaders need to look and operate beyond the existing paradigms of project process and controls. Procedural compliance and engineering management are necessary but not sufficient for complex projects. In addition to the process and engineering of project management, our future complex project delivery leaders need to be developed and selected with consideration to the "art and strategy" of program leadership that incorporate aspects such as systems thinking.

Lack of opportunity for engagement between government and industry. ICCPM's 2009 roundtable series provided an opportunity for senior government and industry officials from around the world to have a safe and nonattributable discussion around the key issues causing complex project failure. Enabling this sort of activity through organizations such as ICCPM, Project Management Institute (PMI), and Aviation Week allows development of a shared understanding and agreed on definition of the issues we face in the project management community. More importantly, the engagement provides the starting point and a vehicle to begin to address these issues.

Future capability (projects) is predicated on attaining rational estimates. There is a need to improve project planning and estimation to be "realistic" and "affordable." Improvement in cost estimation tools as well as benchmarking cost of capability are important aspects of reining in the often overly optimistic view of cost of capability. Failure to do so will result in unaffordable long-term government capability or corporate investment plans.

Current tools and decision processes unsuitable for analyzing uncertainty. In an increasingly complex and ambiguous world, the inability of current tools, processes, and the human mind to analyze uncertainty poses a significant problem. Research investment is required to develop tools that focus on project relationships and interconnectedness of those parts of the "system" that cause uncertainty and thus complexity.

Complex Project Management in Practice

Perhaps the first question to consider in a discussion about complex project management is why would anyone ever contemplate a complex undertaking? Given his-

torical issues with performance and risk of massive and intricate projects, reason might suggest that complexity should be avoided or reduced whenever possible. In most ordinary situations, that approach is entirely appropriate. Nonetheless, there is a powerful and compelling reason for accepting the challenge and risk of a complex project—the potential for greater benefits than would be possible by resorting to a more conventional and simplistic approach. Complexity in any situation must be characterized in terms of not only its principle context-specific attributes but also in terms of what it means from the standpoint of risks and rewards, and to whom both risks and rewards accrue.

So, how do organizations decide to take on the challenge of a complex project? And, once they decide to do so, how do they manage complexity to achieve benefits that make the endeavor worthwhile? Let's examine the nature of what organizations do and how they think about complexity in order to begin to answer these questions.

Stakeholder benefits and the measures of success and failure. One key attribute of nearly all complex projects is that they typically involve a large number of diverse stakeholder communities with a broad range of interests, issues, and levels of activism. In many cases, very powerful and influential stakeholders have no direct involvement in or, in some cases, no real awareness of what is happening within the project. Furthermore, and rather interestingly, we find that quite often the complex project manager has no direct responsibility to key high-level stakeholders, nor do they have any formal accountability (credit or blame) for achieving the desired stakeholder benefits.

For example, in the 1960s U.S. space program, the American public, as stakeholders, was advised by national leaders of the imperative for manned lunar exploration. However, the public had little need or desire for access to information about what was actually being done by NASA project management. Nonetheless, public support was vital to sustain the effort. Generally, however, although NASA leaders and managers had a keen sense of the national will and the high stakes involved, their direct accountabilities were for execution of the manned space project only. They had little or no responsibility for the stakeholder benefits that were to derive from successful project management.

It would be a mistake to discount those stakeholders or to ignore project benefits that should accrue to them. One lesson learned from experience in managing complex projects is to pay attention to the entire stakeholder set and their expected benefits. More stakeholders generally make the effort more difficult to manage, but the reason for giving them voice and consideration is tied to the value proposition of what it means to realize stakeholder benefits. In essence, the more a complex project manager can be accountable to deliver benefits to stakeholders at all levels, the more likely the project will be successful. In this sense, complex project managers draw within the project some of those accountabilities to stakeholders that would ordinarily be external to the project.

The organizational capacity for managing complexity. Ross Ashby, in his pioneering work on cybernetics and systems thinking, contributed what is called the Law of Requisite Variety, which essentially states that the controller of an activity

must have the capacity to deal with at least as much variety as is presented within the activity being controlled. Though seemingly simple, this law has far-reaching implications for complex adaptive systems and the organizations that propose to manage them. One fundamental issue in this regard relates to the choices a management team makes in determining the project's internal scope, and thus the variety within the project system.

As noted in the previous section, for highly complex undertakings where success or failure may hinge upon risks and benefits as seen and experienced by external stakeholders, the organization must often adapt to bring direct or at least indirect responsibility for those requirements into the project domain. For example, the F-35 Joint Strike Fighter program, a U.S. Department of Defense mega-project of unprecedented proportions, affects and is dependent upon many factors that are normally a matter of national or international policies and diplomacy. Although program leaders do not engage directly in international politics, they have in some ways adapted the project organization and its capacity for internalizing and influencing things, such as economic and industrial policies in relation to F-35 worldwide industrial participation. Similarly, some effort has been expended to help ensure alignment of international financial institution expectations in relation to provision of financial support to industries participating in the program. In this latter case, financial institutions benefitted from a better understanding of the nuances of U.S. defense procurement and how limiting factors, such as annual contracts versus single longer-term contracts, affect the risk and profitability of participating international companies. The program has adapted to provide industry engagement that, to a degree, has influenced changes in long-standing practices that would have proven to be overly restrictive if left unaddressed.

The organization as a hierarchy, or a network, or both? Many complexity theorists and researchers are occupied with the study of how complex projects are organized, and how they conduct business in response to a constant demand from the environment for rapid self-directed reorganization. According to complexity leadership theory, complex projects require a balance between administrative, adaptive, and enabling leadership. In this model, administrative leadership implements and manages administrative or bureaucratic policies, procedures, and practices that are essential for any successful operation. Adaptive leadership produces effective and timely responses to the changing business environment and embodies the most innovative and Agile behaviors within the organization. The key contrast here is that administrative leadership generally follows hierarchical lines of authority and positional power structures, whereas adaptive leadership adheres to more of a neural network form of organization and operation that many traditionalists may have difficulty understanding.

A critical truth, however, is that most work in every organization is done without engaging the formal hierarchy. People within even strong hierarchical organizations learn the rules of engagement and then interact with each other with some degree of autonomy to get the job done. The difference in the most capable of complex project organizations is that they possess a strong enabling leadership function that moderates between administrative and adaptive leadership functions to purposefully enhance the adaptive neural network capacities for speed, agility,

and innovation, even while maintaining essential discipline and control throughout the business.

Enabling leadership achieves these outcomes by fostering one-to-one and one-to-many employee engagement and other forms of networking and self-organizing behaviors, while using values- and principles-based leadership techniques to guide the network toward self-control. As one example, Google is well known not only for its innovation, but also for its internal self-control within an environment that is notably unrestrictive except for a simple mantra of "do no evil." It is interesting to note that individuals and work teams at Google usually determine for themselves what is good and what is evil; they do not need the organization to dictate that information to them.

People and discipline. Within the framework of what complexity leadership theory suggests, our real focus is on what people need and how they respond within the work environment to produce outcomes that, in turn, drive value in the form of stakeholder benefits. Although complex situations clearly present new challenges requiring seemingly radically different management approaches, the notion of administrative leadership correctly establishes the need for stability, order, and clarity in organization, processes, and procedures. In essence, a well-formulated organizational context establishes values, boundaries, and operating principles that serve as a stabilizing and guiding reference frame that helps people to accurately interpret meaning from their environment, to make sound judgments, and to maintain effective relationships with one another.

It is vitally important for individuals to maintain very high standards in the practice of their respective disciplines, as lapses in those disciplines, even under ordinary circumstances, can lead to catastrophic consequences. In complex projects, lapses in discipline initiate slow and steadily building erosion affecting the capacity of the organization to hold its ground, eventually leading to failure that is metaphorically akin to a landslide. Thus, although there are certainly some detrimental mindsets created by many traditional forms of education and training, it is vitally important for people to possess a compelling drive for rigor and discipline within their fields of practice.

At this point, it becomes clear that effective organizations give attention to two critical networks that must be developed and maintained. First, leaders support and direct their energy to the building of core disciplines and professional connections that might best be described as communities of practice, where individuals guide and strengthen one another—formally and informally—to drive standards and continuous improvement into their professional practice. Second, leaders also build each project team network by linking nodes in and between the communities of practice networks. That is, they select team members from the communities of practice to participate in the project, where a key *communicated* objective for each individual is to contribute value not only from their personal skills and efforts, but also by leveraging value from their professional network.

Systems thinking and paradoxical leadership. As noted previously, one of the key contradictions facing complex project managers is the tendency for formal training in any field to produce closed or narrow-minded perspectives. Almost every business

enterprise or government organization is confronted with this problem, and its impact is more serious as complexity increases. Although the professional disciplines are critical, how those disciplines are taught and practiced is also very important.

Because complexity presents us with nonlinear and counterintuitive interactions and effects, we need holistic perspectives and systems views of projects and the problems they seek to resolve. For example, traditional teaching, beginning with elementary grade mathematics, science, and even language, gives us insight into the tremendously powerful concept of reductionism—the breaking down of problems into smaller, more manageable parts. This learned practice, though immensely valuable, produces an almost automatic and habitual response to virtually all problems. We become blind to the assumptions inherent in the approaches and tools we choose to apply, and we fail to appreciate how much error those assumptions have introduced. Is reductionism bad? No. It is very good and effective in a wide variety of circumstances, as long as we recognize the limitations of reductionist thinking and where super-position principles—that is, the recombination of the solved parts of a problem—are not valid.

Systems thinking raises our awareness of these limitations and contradictions. A good example of this kind of systems level, holistic thinking is to consider the treatment of physiological problems in the human body. We would find it ridiculous to physically take the body apart, try to fix the individual parts, and then hope to reassemble them into something that would resume normal function. We all know the patient would die. Think about heart transplant surgery and what it takes to keep the body alive and functioning during the operation. In this illustration, we can see that a doctor must consider the whole, even while treating a discrete part, and that there are serious impacts to the whole because of any intervention.

Some of our more complex projects are beginning to resemble the kinds of systems interactions and integrative designs that connect with this example. We are finding many more situations where constituent subsystems and parts have little meaning or verifiable function until assembled into the whole system or a computer-based simulation of that system. Examples might include the most advanced concepts in satellites, unpiloted airplanes, or computer networks that have high degrees of automation and artificial intelligence, even to the point of autonomous decision making and operation.

The complex project manager adopts a different kind of thought process that involves disciplined systems thinking with an acute awareness and sensitivity to the underlying assumptions that are presented within a specific problem or project. There are many valuable techniques that can be employed to discern those assumptions, to assess their implications, and to identify alternative definitions of the problem, assumptions, and possible solutions. Tony Proctor among many others, provides an excellent summary of creative problem solving techniques, including methods for lateral thinking that facilitate the challenging of constraints, paradigms, and assumptions. These are important tools and techniques for all team members to employ.

Using such techniques, a skilled complex project management team directs their focus on a deeper issue. For at the root of many incorrect or misapplied as-

sumptions, there are fundamental contradictions or paradoxes that cannot be overcome by conventional reductionist thinking. Many assumptions are planted at what appears to be the boundary of conflict between two or more contradictions. Fred Smith and FedEx saw an unchallenged assumption, a paradigm that constrained a whole world of intelligent people. FedEx chose to reverse the assumption with a twist of integrative, holistic thinking that said there is a viable business case for shipping a package from any one place in the United States to any other place in the United States *and* doing it overnight. They saw the paradox. They took an assumed "either-or" constraint, inserted "and" instead, and with some hard work along the way they created a new industry. Complex project managers understand the nature and need for the practice of paradoxical leadership—seeking and finding the paradoxes—those contradictions that serve as signposts to important breakthroughs. The breakthrough is initiated by challenging the contradiction, and fulfilled in finding a creative way to simultaneously satisfy what once appeared to be mutually exclusive constraints. Solving a riddle that poses an apparent contradiction is a metaphor for this type of thinking.

Leadership through values, vision, and principles. In his book *Principle-Centered Leadership*, Stephen Covey discussed the idea that much of true leadership is exercised by communicating a vision and a plan that appeals to the values of people through principles. Principle-based leadership provides a solidly anchored reference frame that serves as both a sure foundation and a navigation aid for decision making. As a foundation, guiding principles communicate security and confidence to team members, much like a handrail or ladder might do on a steep mountain trail. As a navigation aid, guiding principles give clarity to position and heading, just as the earth's magnetic field would convey through a compass and as the constellations would reveal through a sextant. The latter metaphor is useful by extension to point out that truly sound principles are transcendent; they hold true no matter where you are or whom you are with. This metaphor further illustrates that principles have within them what is needed, such as a stable magnetic field, where some form of tool or technique or understanding may also be required, such as a compass, in order to derive something of value.

In complex environments, we are often faced with one of those paradigms that need to be broken. Many project managers think as if every problem has a solution for which there is a paved road or high-speed rail that will get them there. To the informed complex project manager, there is a whole new set of perspectives and skills, and a clear realization that much of what is required involves exploration and "living off the land"—that is, creating what is needed from what the local environment provides at that moment.

Correspondingly, much of traditional project management training provides the equivalent of a driver's license, with an emphasis on how to do many things that have been done many times before and for which a lot of standards and road signs are in place. Complex project management training, on the other hand, amounts to something equivalent to multi-climate survival training, where a lot of knowledge is required, but where wisdom, discernment, and good judgment are most important. Complex project managers read the environment, regard the terrain, and understand how to eat, breathe, and live on the move through the unknown and

unexplored territory to the next waypoint on their journey. They do not know all that they know through book knowledge or formal directed learning, but through knowing the principles of where to find water, food, and shelter, and how to determine what direction to head in and how to navigate along the way. Complex project managers guide and are guided by principles because principles give them both a firm foundation of reliable knowledge and the ability to adapt that knowledge readily to changing or radically different circumstances. Principles equip, enable, and empower leaders to handle the unknown.

Sense-making leaders makes sense. In maintaining the connection with the model of principle-based leadership and the explorer metaphor, another key attribute of effective complex project managers is their multi-paradigm adaptive leadership style. They recognize that some circumstances call for a conventional ready-aim-fire approach. What sets them apart is that they also know that under completely different circumstances, a fire-ready-aim approach is needed and is much more effective. Conventional thinkers are smirking and mocking in response to that idea. However, researchers such as Kurtz and Snowden, Snowden and Boone, and Palmer, Dunford, and Akin have long studied and validated that leaders who adapt their behaviors, styles, and modes of leadership to the situation at hand are much more effective than leaders who expect those being led to adapt to their dominant style of leadership.

Consider a disaster response team that is dealing with a disaster they never trained to handle. Disasters do not allow time to think or coordinate. Either responders know what to do or they are paralyzed with inaction. Under those circumstances, the only effective approach is for the responders to do what they know to do, react to what they sense, and then identify the next course of action: fire, ready, aim. Leaders in radically complex environments sometimes need to take action first, and make sense of the situation afterward.

Even in less challenging and risky environments, the notion of floating trial balloons or surveying a population for what they might prefer or find acceptable is common practice. A study of how the Japanese auto industry achieved traction in the U.S. market reveals that it was accomplished mostly through trial and error. Japanese automakers, most notably Honda, explored options, made small but well considered investments, and identified by way of exploration the right path and approach for action. Interestingly, as a tangential point, this was a strategy implemented to perfection; however, some highly regarded experts on strategy thought it was not "real" strategy at all. Those individuals were blind to the strategy that defeated them because their internal definition and paradigm held that strategy involved a predetermined destiny directed from an all-knowing supreme leader and carried out faithfully by motivated subordinates. A strategy enacted by a leader who embraces an explorer mindset and leads a team accordingly is indeed a strategy, and one that is likely prevail under many circumstances, particularly those dominated by ambiguity and uncertainty.

Systems and processes to facilitate the discipline of business. In closing, it seems an appropriate time and place to address some other fundamental and often overlooked aspects of management that, because of being overlooked, become obstacles to success in managing complexity. Every business has systems, processes,

and a way of doing things that are part of the formula for its success. These systems and processes should rightly represent a framework for business execution that inherently includes standards for behavior and action that contribute stability and predictability to the enterprise. For the same reasons, though, all business systems and processes can over-constrain or under-constrain the behaviors and actions they are intended to control. Even in high performing organizations, there are likely to be some business processes that need to be refined, modified, or replaced. The organizations in today's volatile business environment need to know that the leap into the domain of complexity is extraordinarily risky for those who are not adequately prepared.

For example, an organization that has loose or ambiguous controls in place for financial or schedule management is inviting disaster. Undisciplined management controls lead to unclear expectations, inaccurate reports on performance and current position, and inadequate advanced warning mechanisms that protect the business from critical failure. Similarly, the introduction of new and unfamiliar systems, such as S.A.P., can produce significant temporary disruption and confusion, particularly if combined with the ambiguities noted above. When these fundamental systems and processes fail or falter, the organization loses its ability to sense and see what's happening. Furthermore, when cost and schedule are important to external stakeholders, poor management controls cause them to lose confidence quickly. Complexity makes these problems worse, and sometimes fatal to the project or business. For all involved, life is better if the organization is constantly maintaining or improving its business systems and processes, and ensuring that there is adequate rigor, discipline, and quality in them.

This dilemma becomes even more difficult to deal with where partnering is required. The fundamental issue here is within the premise for selecting a business for collaboration. Companies choose partners who have demonstrated that they have unique skills, tools, and capabilities along with their own company-unique systems and processes to manage themselves effectively and successfully. To ask that organization to change significantly toward becoming at best a second-class copy of another means that they are being asked to change the formula that made them successful. That doesn't sound like a good idea, but neither does operating in partnership with a company that has substantially different systems and processes that make planning, scheduling, budgeting, and performance reporting troublesome, thus jeopardizing the project. Both options have the potential to negatively affect the value contribution of the partner. This is another of those paradoxes that complex project managers must recognize and mitigate based on the specific context of the business situation.

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