

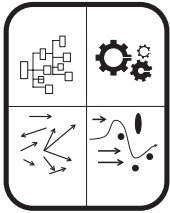
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Leading Complex Projects

KAYE REMINGTON

GOWER

Comprehend Complexity



I understand, if we are on the one-hundred-eightieth meridian, we are at the Solomon Islands. But how do you know we are actually on the one-hundred-eightieth meridian?...You find the Solomon Islands and you have learned where is the hundred-eightieth meridian, and you know where are the Islands of Solomon! But why must those islands lie on that meridian?

Umberto Eco, The Island of the Day Before, (p. 253).

The notion of comprehending complexity might appear to be somewhat incongruous. Many writers argue that it is impossible to understand something which is truly complex. Nevertheless, people do lead and manage projects that are extraordinarily challenging; projects exhibiting characteristics that are associated by scientists with complexity. The ability to comprehend that the project is something out of the ordinary seems to be the first step in being able to deal with it effectively.

Key Points in This Chapter:

- Importance of early recognition of complexity by all stakeholders.
- The difference between complex and complicated projects.
- Indicators of project complexity.
- Project specific factors contributing to project complexity.

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Part 1: The Importance of Recognising Complexity ASAP

There appears to be a positive correlation between project success and the capacity of the executive sponsor and other key project leaders to recognise complexity and support the project manager and project team in managing the complexity (Helm and Remington, 2005; Crawford et al., 2006). There is also generally agreement amongst experienced project leaders that if you can get as many key players recognising that the project or programme is more than just complicated or challenging, the better the chance of achieving desired outcomes. This was a strong point of agreement amongst leaders of complex projects at all levels. It was one that was brought up again and again, particularly when discussing projects that had gone wrong. The act of early recognition by key players that the project is likely to be complex has the beneficial effect of alerting decision-makers to the need for special consideration, and hopefully also of engaging them in constructive problem-solving.

The early phase of that programme, the requirements, was a very good example of a few people really grasping the complexity issue. Interview 63.

As the project director of a very successful international defence project observed, experienced project leaders often know in advance when a project is likely to be extraordinarily challenging. On the other hand, others associated with the project might not have the same level of experience, either with complexity, or projects, or both. Tools to help identify and assess the level of complexity are very useful, especially if they also engage key decision-makers in ownership of the complexity through recognition and comprehension.

NOT ALL KEY STAKEHOLDERS UNDERSTAND COMPLEXITY

However, it cannot be assumed that all key players will understand the complexity. Inability to comprehend the level of complexity might be related to experience or to personal characteristics, such as learning style or the way the person comprehends the world as the following extract from an interview with a senior IT project manager reveals:

The project on paper actually looked easier than it was, and [the sponsor] hated that ambiguity. And it was very conceptual as well. It wasn't one plus one equals two, at all ... so they [senior executive] struggled with it. So you'd deliver pieces of information in small chunks, so they could go okay I understand that, let's move on to the next step. Interview 17 PM.

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Unfortunately, in the first part of our study (Helm and Remington, 2005a, 2005b) this kind of response was the rule rather than the exception. For that part of the study we focused on experienced project managers who had successfully delivered projects that also had been deemed by colleagues and other key stakeholders as complex. Unfortunately the vast majority of the senior project managers interviewed reported that they managed in spite of senior executives' unwillingness or inability to recognise the level of complexity exhibited by the project. They were 'managing around' senior project executives!

The implications from the first study are quite serious. If experienced project managers believe they have to simplify and filter information for executive leaders, who might be unwilling or unable to address the true complexity of the project, opportunities for conversations with senior executives that might have important implications for the project are effectively reduced or even eliminated. Theoretically, senior executive leaders are the ones who have most immediate access to knowledge about wider environmental and organisational changes that might impact the success of the project or programme. A few project leaders reported better experiences.

The sponsor, who was at a particularly high level in the organisation, would regularly email me or send messages via her colleagues to alert me to something which was going on in the organisation, which might potentially have some impact on the project. In such a large and diverse organisation, I [PM] could not possibly have access to her knowledge at an organisational level. This was invaluable. Interview 11 PM.

Without access to this important information it can be very difficult for a project leader to negotiate the field and successfully deliver the project or programme. While the senior project managers found ways to deal with ineffective senior executives, the same could not be expected of less experienced project managers.

TEAM PERCEPTIONS

It is also important that leaders acknowledge complexity with project teams. Teams may experience complexity as confusion, distress or loss of confidence in themselves and the leadership. The most frequent response at the team level is aversion to complexity – 'that's too complex; it's all too much; let's try and simplify it'; but some problems are not simple and the act of simplification can involve making selections and choosing pathways at dangerously early stages of a complex undertaking or project.

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Recognising that a project is complex and then determining how complex and in what way, is the first key. The first part of this research also provided some input for the first book in this series, *Tools for Complex Projects* (Remington and Pollack, 2007). In preparation for that book we looked for special ways in which experienced project managers were working with complexity; tools, methods and approaches that were non-standard. For that book, my colleague, Julien Pollack, and I developed a method to help practitioners to identify and analyse project complexity based on the source of the complexity.

Part 2: How Are Complex Projects Different From Complicated Ones?

A number of authors have demonstrated that projects, like organisations, can be likened to the complex adaptive systems found in nature (see for example: Ivory and Alderman, 2005; Jaafari, 2003; Williams, 2002; White 2001; Baccarini, 1996; Stacey, 1991). When we look at many of the recommended practices in the project management literature it becomes apparent that, although projects are often thought of as systems, they are treated as simple systems. In a simple system, like a straightforward project, we can assume a problem can be defined properly and completely at the start of a project. As we monitor the project we might observe that there is a variation from the goal-path. Usually we then take some remedial action to return the project to the goal-path. We call that monitoring and controlling. If we are lucky the project more or less reaches its initially defined goal. It behaves like a simple system (Figure 1.1). But let's face it how many projects really behave like this?

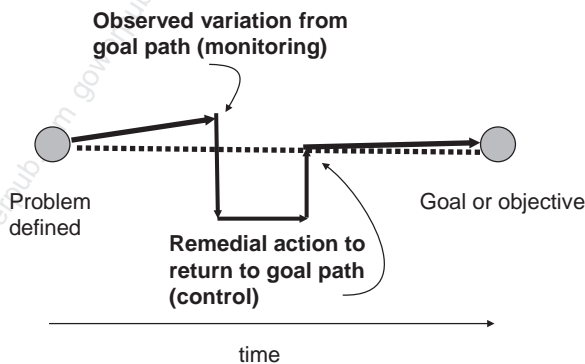


Figure 1.1 A diagrammatic representation of a simple, goal-seeking system

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COMPLEX SYSTEMS

Likening complex projects to the complex adaptive systems found in animals and plant systems incorporates the notion that projects exist in the social world, which is a complex adaptive system (Eisner, 2005; Axelrod and Cohen, 2000). Implicit in the notion of a complex adaptive system are questions about whether all projects can be expected to behave in predictable ways, the way we expect a mechanical system (or simple system) to behave. A simple mechanical system, like a car, has a very high likelihood of getting us from A to B if we can guarantee certain conditions: the mechanical parts are in good working order; it is filled with the right kind of fuel; the roads are in a passable condition and there are no physical barriers like traffic jams, fierce storms or landslides and the driver is competent. If all these requirements are fulfilled there is a high likelihood that we will arrive at our destination within a reasonable time-frame.

When systems become more complex, the level of certainty of achieving our goals decreases. Even expectations around the simple car journey can become less predictable when we add in human error. Perhaps someone forgot to fill the car up with petrol, or the driver was chatting to passengers and missed a turn, or much, much worse, missed some ice on the road and the car skidded causing an accident. Or, other drivers on the road were not careful and the driver rolled the car trying to miss an oncoming vehicle. The very fact that all projects involve people means that all projects might legitimately be described as complex systems. Nevertheless, it is important to acknowledge that there are degrees of complexity and it is even more useful to be able to distinguish in advance projects that require extraordinary efforts to manage from those that are routine.

SIMPLE, COMPLICATED, COMPLEX OR CHAOTIC

One of the questions that vex both practitioners and academics is how is a complex project is different from a complicated or difficult project and when does a project become chaotic, or out of control?

As Figure 1.2 illustrates, depending on whether the outcomes can be controlled precisely, we can think of projects or parts of projects as being anywhere on a continuum between control and chaos, with simple projects at the control end and out of control projects at the chaotic end of the spectrum. The majority of projects exist in the complicated or complex space. Thankfully not many projects enter the turbulent, chaotic space. If, having entered the chaotic space, they cannot be quickly brought back into the complex space,

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they usually collapse. Not many projects are really simple because all projects involve people and people have a tendency to make things complicated. Complicated projects can be very challenging but there is usually a way through if we can get the right experts working on the problems. Once we move into the complex space the connections between causes and effects are more difficult to discern, people become anxious and outcomes are extremely difficult to predict with any degree of certainty. However, projects do not remain in one space, they can quickly move from the control end to the chaotic end. Also, as we shall explore later, parts of projects can be in control while other parts can be complex or even chaotic.

At this point the sceptics might ask whether complexity in relation to projects is just a matter of semantics. In a practical sense, whether or not a project is considered to be complex, or just very complicated, *is* a matter of perception, related to experience and familiarity. Lack of experience can increase the apparent complexity or difficulty of a project because a less experienced person does not have access to the range of responses available to a highly experienced person. When a project, or part of a project, moves into the complex space events follow each other very rapidly. Then, making the wrong decision at key points, or avoiding action, really matters.

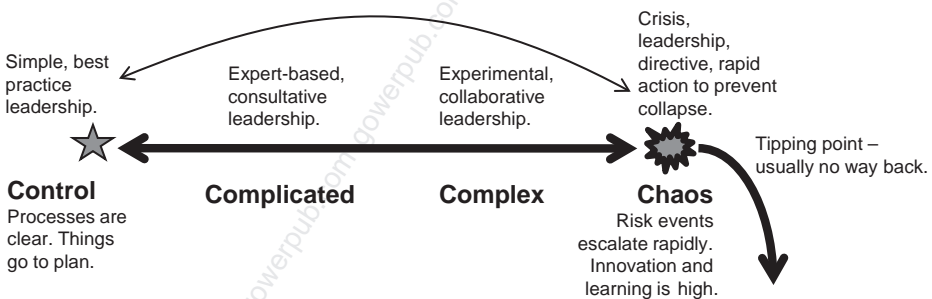


Figure 1.2 Most projects exist on a continuum between control and chaos (developed and adapted by the author for projects from Snowden, 2002)

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Part 3: Indicators of Project Complexity

There are several indicators that experienced people can use to gauge the level of complexity of a project. It is important to remember that indicators are contextually sensitive. Whether a project or programme is perceived to be complex depends on the people concerned, their experience, the environment and other pressures, such as tight deadlines.

UNCERTAINTY

One way of differentiating a complex project or programme from a difficult, but ultimately manageable one, involves identifying the point in time at which the exact nature of the deliverables or how to get there is no longer clear or certain. In the quote at the very beginning of this chapter from the book, *The Island of the Day Before*, Umberto Eco's characters are expressing the kind of uncertainty that people experience in a complex world as their own deeply held versions of reality are challenged. Uncertainty can occur when information is lacking or inadequate; when the details are ambiguous, complicated or unpredictable. It can also occur when people feel unsure about their own knowledge or available knowledge in the field as a whole (see Babrow et al., 2000; Babrow et al., 1998). Because the perception of uncertainty is a subjective perception based on a person's ability to know or understand the world, 'a person who believes himself or herself to be uncertain is uncertain' (Brashers, 2001, p. 478). From an objective standpoint, the required knowledge might be available, but if a person believes that s/he cannot make a decision on the basis of that knowledge then s/he might still be uncertain. Therefore, feelings of uncertainty depend both on the knowledge available to the people concerned and their own perceptions of their ability to access it or use it. Perceptions of uncertainty can also be related to a person's assessment of the probability of an event. When people relate the probability of an event to their feelings of uncertainty the relationship is not linear (Babrow, 1992).

TRUST

Uncertainty reduces people's confidence in themselves and in the leadership. It therefore contributes to lack of trust in people associated with the project (see Geraldi and Adlbrecht, 2007; Geraldi, 2008). Feelings of discomfort due to uncertainty can be to do with the scope or direction of the project, or technical, budgetary and schedule risks. Reduction of confidence negatively impacts on our ability to deliver and can adversely affect the trust in those on whom you

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A significant delay in one activity in a dense network of activities like this one can have an effect on many different activities in the project. This is simply due to high levels of interconnectivity and interdependence that produce cycles of rework which are often difficult to anticipate at the outset of a project.

Part 4: Project Specific Factors Contributing to Project Complexity

Complexity associated with projects has been attributed to a number of factors. As mentioned earlier some causes are directly related to who is involved with the project, the capabilities, motivation and commitment of the key personnel (executive sponsors, clients, user representatives, project managers and project team members). Other causal factors stem from the physical nature of the project, such as its size, the organisation structure, the technical challenges and how the project is affected by deadlines and time-related issues. However, there is rarely just one causal factor and perceptions of the complexity of the project are more likely to be influenced by an intersection of these aspects.

For example, in one very large project we investigated in the energy sector, theoretically avoidable complexities were traced back to poor cost and time estimates during the feasibility phase that were related to pressure from senior executives to get the project started. A culture of optimism was accompanied by an unwillingness by senior executives to acknowledge the seriousness of the risks that had been identified and reported by project personnel. This situation was underpinned by a lack of relevant expertise at senior executive levels and apparent unwillingness to co-op others who did have the right expertise. Technical challenges that were impossible to solve in the time-frame led to wildly inaccurate guesses and inappropriate choice of procurement systems for the level of complexity of the project. Some of these conditions, such as over-optimism, pressure on project personnel to get started, sponsors' inability to acknowledge the levels of risk when reported by the project manager, sponsors' lack of understanding of the need for highly experienced project support personnel and so on are directly related to leadership capability and behaviour. Other causal factors were related to the nature of the project itself – innovative, technically challenging, involving a multitude of authorities with contradictory requirements, the public visibility of the project and public concern over environmental issues associated, the scale of the project and the lack of appropriate support structures in place within the owner organisation.

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It is the intersection of the leadership capability at all levels of the project and the nature of the project itself that can seriously affect how complexity is addressed. Uncertainty about how to proceed, ambiguity about what is happening at any one time, loss of trust in colleagues and key stakeholders and loss of faith are consequences. These characteristics might also provide us with ways of assessing the level of the complexity for the organisation and context.

In our previous book, *Tools for Complex Projects* (Remington and Pollack, 2007), we offered a model and tools for identifying and categorising the complexity based on contributing or causal factors. Organisation specific tools are currently being developed by large organisations for their own use in differentiating complex projects from standard ones. Whatever methods a leader uses, the purpose is the same, to help others recognise the nature and degree of the complexity early enough so that the best decisions can be made to assist project delivery. Putting our heads in the sand is not an option with a complex project or programme.

HOW COMPLEXITY IS AFFECTED BY PROJECT ORGANISATION OR STRUCTURE

Project organisations can be considered to be networks of information exchange. It is theoretically possible to measure the number of possible pathways in a complex network but it is often very difficult or even impossible to predict how the pathways might be affected when changes are imposed from outside the system, for example, Figure 1.3 illustrates a project decision network in a defence industry project which had many interdependent and co-dependent activities. When a delay occurred in pathway E (due in this case to a key stakeholder withholding approval due to political issues about the scope, but it could equally have been due to a supplier monopoly or a technical design issue) there was a knock-on effect that impacted the whole project. This effect alone could have been dealt with by a schedule variation but in a complex system there is the propensity for cyclical reinforcement where delays in later pathways start to influence and make redundant tasks and processes that have already been completed – the classic rework syndrome.

In large projects with many interrelated and interdependent activities this kind of effect, resulting in excessive amounts of rework, is not uncommon. Often called 'vicious cycles', these patterns result in what complexity theorists call 'emergence'. The system starts to turn into something different and the outcomes can be altered considerably. In the case of the project in the example

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above cost budgets and the schedule started to get out of hand until the only option was to shut down the project causing substantial embarrassment to key stakeholders. Unfortunately this is also when litigation takes over and relationships between parties can become nasty.

TECHNICAL DIFFICULTIES THAT CONTRIBUTE TO COMPLEXITY

One expected source of project complexity is technical difficulty (Turner and Cochrane, 1993; Payne, 1995; Williams, 2002). Technological novelty, task uncertainty and the ability of the organisation to cope with technological novelty have been cited as specific causes of complexity (Taikonda and Rosenthal, 2000; Pundir et al., 2007). Technical and design challenges are commonplace in projects, however, if they appear to be insurmountable, or at least insoluble within an acceptable time-frame, they contribute to uncertainty and lack of trust between key stakeholders, which might increase the perception of complexity (Müller and Gerdali, 2007). Also, design and creative activity is by definition nonlinear. Inherent in the design process are positive reinforcing loops, hopefully 'virtuous cycles', leading to new ideas and knowledge (Kokotovich and Remington, 2007), rather than 'vicious cycles' leading to potential disaster (Williams, 2002). However, there can be many frustrating dead-ends when trying to solve technical design problems. Jones and Deckro (1993) add another aspect to technical complexity, that of instability of the assumptions upon which the tasks are based. Williams (2004) also refers to 'aleatoric uncertainty', which is inherent uncertainty relating to the reliability of calculations and what he calls 'epistemic uncertainty', stemming either from poor mental models or lack of knowledge within the technical field.

TIME AND PROJECT COMPLEXITY

By definition projects are time-driven. However, the degree to which time affects the project is relevant here. A number of authors (Clift and Vandenbosch, 1999; Williams, 2002) argue that an increasing desire to reduce time to market is an important source of complexity. How pressure due to time affects decision-making in teams and amongst other key stakeholders is not well understood at all (see Chapter 6).

The way different key stakeholders experience time is, in itself, a source of complexity. We know that time is perceived differently at the beginning of project, in the middle, and at the end. It is also perceived differently by different people associated with the project (Remington and Söderholm,

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2010). For project team members, sensitivity to the passage of time changes throughout a normal project, with time perceived as more at the start of a project, contracting as the project progresses (Gersick, 1988). For stakeholders who are not actually involved in managing the project, time can be perceived differently. Entrepreneurs, for example, might be more conscious of time at the beginning of the project when there is pressure to commit to key financiers. Project financiers are likely to be highly conscious of time towards the end of schedule when benefits are close to realisation. This is a common phenomenon in the property development field where buildings need to be leased quickly in order to achieve satisfactory returns on investment, or in manufacturing industries where time to market is critical to the success of a product.

Particularly as many projects last for extended periods, over several years, they become increasingly subject to effects which might be avoided in projects of a shorter duration. These projects are affected by a range of environmental impacts, including political upheavals, local and worldwide economic crises, major regulation changes, mergers and replacement of key personnel. At the time of writing a major rail extension project was summarily cancelled in Sydney, Australia, due to a change in Premier and Cabinet and a crisis in confidence, partially related to global economic pressures. The repercussions for contractors and other stakeholders, such as affected local businesses, are serious.

LACK OF CLARITY ABOUT GOALS

Apart from being the most identifiable symptom of complexity, uncertainty itself, can also be a primary cause of complexity. At project initiation, a lack of a shared understanding about goals and goal-paths, or goals that are understood differently by individual stakeholders, can contribute to feelings of uncertainty. If not recognised and addressed early decision-making can be affected and the level of uncertainty may increase as the project progresses (Remington and Pollack, 2007; Remington et al., 2009). Uncertainty as a causal factor has been explored by a number of authors (Williams, 2002, 2005; De Meyer et al., 2002).

COMPLEX PROJECTS IN A NUTSHELL

Briefly we can describe a complex project as one which involves abnormally high levels of uncertainty, ambiguity and associated reactions, such as decreasing levels of trust. These characteristics might stem from some or all of the following characteristics (see Remington and Pollack, 2007):

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- Highly networked, interdependent and co-dependent tasks.
- Complicated and interdependent communication pathways, often found where there are many different reporting pathways and diffuse or conflicting authority.
- High levels of technical uncertainty such that suitable technical solutions might not be available within the time.
- Many disparate groups of stakeholders with competing agendas that are difficult to understand, track and manage, as found in projects with political or societal implications and multi-owner projects.
- Several different work or national cultures involved, as often found in multi-national and cross-agency projects.
- Lack of clarity, shared understanding or vision about goals and goal-paths at any level of the project.
- External environmental changes, political, regulatory, technical or organisational, that are unusually difficult to predict in terms of impact and time.
- Other time-related pressures that have abnormal impacts.
- Unexpected emergent behaviour resulting in rapidly escalating risks due to the triggering of a series of small events which might be previously have been thought to be unrelated.

Projects afflicted by any or all of these conditions are likely to behave in ways that make reliable prediction of outcomes, (in terms of costs, budgets, scope, quality and value) difficult, if not impossible. Often these projects are plagued by negative behaviour that comes with uncertainty and eventual undermining of previously good relationships. If these projects are not led effectively at all levels they can fail in many ways.

The majority of interviewees in our research were working on large scale and mega projects but there were also interviewees who were working on relatively low budget projects that also fit our definition. Most of these smaller

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projects were culturally or politically sensitive and the reputation of the project owners and other key stakeholders rested heavily on their success.

Understanding many of the factors that contribute to complexity in a project matters because practitioners can be forewarned and therefore forearmed. More importantly project leaders can forewarn key stakeholders, such as the project owners, clients, executive sponsors, end-users and champions. The ability to predict that a project might become complex, even if the exact nature of the complexity cannot be exactly, was acknowledged as very important by many of our respondents.

In Summary

Complex projects, like complex adaptive systems, are characterised by high levels of:

- Uncertainty
- Ambiguity
- Decreasing levels of trust.

Risk events are likely to have emergent, non-linear characteristics which increase the level of uncertainty.

Event pathways are often not predictable. Therefore, early recognition that risk events might escalate in a non-linear, unpredictable way might encourage decision makers to make sensible and timely decisions about communication, key role capabilities and governance. It has the affect of raising the general level of alertness and an atmosphere of preparedness develops.

Nevertheless, as indicated by some of the interview reports from our research, getting key senior stakeholders to understand and acknowledge the likelihood of the effects of complexity is not always easy.

In spite of the uncertainty many complex projects are led and managed successfully and this book endeavours to explore those factors that have contributed to their successful leadership.

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