Abstract

Investigating an Interpretive Framework to Manage Complex Information Technology Projects

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The aim of this paper is to describe a doctoral research being undertaken by a practising project manager managing a variety of information technology projects in the telecommunications sector in Australia. I feel that the current methods of handling IT projects using normative approaches are ineffective as they do not help to comprehend the reality of the project situations which are emergent and uncertain. I plan to study these projects using five lenses derived from a review of the literature and personal observations to find better ways to deal with the complex nature of these projects. I plan to use a multiple case study approach using participant observation, interviews and secondary data from a purposive sample of projects to explore the complexity of these projects. I will use grounded theory techniques to analyse data. I plan to triangulate my findings by discussing key themes derived from my data analysis using a focus group of experienced project managers in Australia. I have conducted a pilot case study in my organisation and presented my research for a trial assessment at the faculty where I am enrolled as a doctoral student and obtained feedback from academics and practitioners. I am now preparing for my assessment in May 2009 before I am allowed to apply for human research ethics approval to the University to start real data collection. I expect that some initial findings from the data collected could be presented at the IRNOP conference in October. The paper is jointly written by me and my supervisor who was also a practising project manager of large-scale distributed control systems projects in industry before becoming an academic.

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Abstract

The aim of this paper is to describe a doctoral research being undertaken by a practising project manager managing a variety of information technology projects in the telecommunications sector in Australia. I feel that the current methods of handling IT projects using normative approaches are ineffective as they do not help to comprehend the reality of the project situations which are emergent and uncertain. I plan to study these projects using five lenses derived from a review of the literature and personal observations to find better ways to deal with the complex nature of these projects. I plan to use a multiple case study approach using participant observation, interviews and secondary data from a purposive sample of projects to explore the complexity of these projects. I will use grounded theory techniques to analyse data. I plan to triangulate my findings by discussing key themes derived from my data analysis using a focus group of experienced project managers in Australia. I have conducted a pilot case study in my organisation and presented my research for a trial assessment at the faculty where I am enrolled as a doctoral student and obtained feedback from academics and practitioners. I am now preparing for my assessment in May 2009 before I am allowed to apply for human research ethics approval to the University to start real data collection. I expect that some initial findings from the data collected could be presented at the IRNOP conference in October. The paper is jointly written by me and my supervisor who was also a practising project manager of large-scale distributed control systems projects in industry before becoming an academic.

Keywords: Complexity, Information Systems, Project Management, Practitioner Research, Telecommunications
**Background**

I have been practicing as a project manager for the past ten years and technical architect for more than five years, mainly in IT system development and implementation projects. I am currently employed in the telecommunications sector in Australia. As I started managing more projects using standard project management methodologies, suggested by the professional bodies of IT and project management and adopted by my organization, I have experienced the limitations of these methodologies in dealing effectively to manage projects when the project team is faced with novelty, uncertainty, emergent change, variations, ongoing construction of what the project was really about, the multiplicity of social interactions and power plays that occur in our projects.

I am keen to explore alternate views of project management by proposing a framework for IT system projects that takes into account the complex aspects of system implementation projects where people, processes and technologies interact closely. I believe that understanding the combined interactions of various elements of a project is more important than studying individual aspects. This led to my enrolling in a doctoral program at a university to a study of ‘whole-part” concept of IT projects. I also found a supervisor who was interested in the application of systems and complexity theories to real-world projects. As I started reading more about complexity theory I attempted to depict organic formulations of events in a project using examples that I came across in my readings dealing with nature and metaphors. I attempted to use these metaphors to describe the events that occurred in projects that I was managing, such as the ‘butterfly effect’ with my peers. This led to several informal ‘water cooler’ conversations with my peers on the use of systems theories to project management. Soon I realized that systems theories also have limitations to predict some of the events that occurred in projects in my organization. This resulted in an interesting conversation with my supervisor who teaches and writes papers about the application of systems theories to project management. Thus began this exciting journey into the realms of complexity to understand why certain phenomena occur and explore the *actuality* of such phenomena using metaphors used in complexity theory in IT projects.
IT projects

Information technology is having an indelible impact in our daily lives and has revolutionized the way businesses operate globally. Innovations in IT have led to the emergence of a global knowledge economy providing unlimited and instant access to information across demographic boundaries. Many IT systems are now implemented through outsourcing arrangements to countries like India and China. Advances in information and communication technologies have led to dynamic, volatile market conditions such as the one we are facing now, tougher competition, variety of demands, shorter shelf life, multiple players and complex trade regulations. Businesses are forced to do more with less and there is an expectation that IT systems would help them to deliver projects in shorter spans of time at lower costs and support and enable competitive strategies. On the other hand, rapid technological obsolescence, diverse cultural workforce, scarcity of skills, fragmented system development processes and communication issues have resulted in increased complexity of IT projects creating barriers to their successful implementation. Under these conditions project managers like me are expected to deliver projects in time, within budget and meet customer needs.

The literature has recorded increased IT project failures despite advances in the application of development processes based on software engineering concepts, tools and project management practices. There is concern among the academic and practitioner communities that while normative project management methodologies are useful to manage the projects with clear goals and processes, they seem inadequate in explaining the inherent complexity of projects with unclear goals and unknown development processes.
The question then arises, “Is there a paradigm shift in defining projects and their activities using conventional project management methodologies? Is there an alternate explanation to help us build a framework to gain better insights into the complexity of the projects so that the project management community could benefit by such an interpretation?” I have reflected on these questions and found, through an initial literature review, that the principles and metaphors of complexity theory could provide interpretive lenses for exploring complex IT projects. This became the focus of my doctoral study. During my trial assessment at the university where I am enrolled there was general encouragement by academics and practitioners to pursue my journey.

**Why complexity theory is useful to study IT projects**

I provide a brief review of the literature covering reasons for IT project failures, complexity in projects, complexity in IT projects, complexity theories in project management and researching project actuality in this section to justify my research.
Why IT projects fail

A review of the literature on failure and reasons for the failure of IT projects provides many reasons for these failures (http://www.it-cortex.com/Stat_Failure_Rate.htm);

- The KPMG Canada Survey (1997): 1,450 public, private sector organizations interviewed by KPMG Canada, 61% considered as failures, an estimated $25 Billion overrun is reported. It is to be noted that 31% of the organizations had project management frameworks and processes in place.
• The Robbins – Gioia Survey (2001): 51% of the companies viewed Enterprise Resource Planning (ERP) implementations as unsuccessful. 56% of the companies surveyed used professional project management methodologies based on Prince 2 or the PMBOK®. 36% of ERP projects were unsuccessful even though they had Project Management Office (PMO) in place.

• The Chaos Report - Standish Group (2004): 53% of the IT systems projects faced significant challenges, out of which 29% succeeded whereas 18% failed completely.

The literature also points to failures in IT projects in Australia. Glass (2006) states that three years later after spending A$150 Million, Westpac Bank cancelled one of its strategic IT projects. Avison et al(2006) provide examples of three IT projects - Royal Melbourne Institute of Technology (RMIT)’s ERP System Implementation, Sydney Water billing and Customer Relationship Management (CRM) system and One Tel’s billing systems as catastrophic failures. They point out that ‘Sydney Water did not oversee the project as effectively as it should have and understanding of the project particularly in light of its complexity’ (p. 93). Several reasons have been cited in the literature as to why IT projects fail. Table 1 categorises these issues into people, systems/methodology and technology issues.
Table 1: Reasons for IT project failures

<table>
<thead>
<tr>
<th>Authors</th>
<th>People</th>
<th>Systems/Methodology</th>
<th>Technology</th>
</tr>
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<tbody>
<tr>
<td>Smith (2002)</td>
<td>Lack of skills</td>
<td>Unsound business case</td>
<td>Technology</td>
</tr>
<tr>
<td>Avison et al. (2006)</td>
<td>Unrealistic expectations</td>
<td>Poor vendor management</td>
<td>obsolescence</td>
</tr>
<tr>
<td>Bull Survey (1998)</td>
<td>Management</td>
<td>Fixed-price contracts</td>
<td>Poor choice of</td>
</tr>
<tr>
<td>Strassman (1985)</td>
<td>commitment</td>
<td>Lack of formalized</td>
<td>Technical platforms</td>
</tr>
<tr>
<td>Nah Fui-Hoon, Lau</td>
<td>Inadequate governance</td>
<td></td>
<td>approach</td>
</tr>
<tr>
<td>Lee-Shang &amp; Kuang (2002)</td>
<td>Organizational politics</td>
<td>Changes in competitive</td>
<td></td>
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<tr>
<td></td>
<td>by different players</td>
<td>Changing requirements</td>
<td></td>
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<tr>
<td></td>
<td>Intensive fiddling</td>
<td>Lack of planning</td>
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<td></td>
<td>Different organizational</td>
<td>Stakeholder management</td>
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<td></td>
<td>cultures</td>
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<td></td>
<td>Poor communications</td>
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<td></td>
<td>Lack of user</td>
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<td>involvement</td>
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<td>Sense making</td>
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Developed for this paper.

Some recent literature on the failure of IT projects also points to increased complexity (BCS 2004; Glass 2006; Murray 2000). This is to be expected for as Table 1 shows many issues for failure of IT projects have to do with people and organizational factors rather than technology related.

**Complexity in projects**

Projects are viewed as temporary organizations that perform unique tasks that have a beginning and an end within a permanent organization (unless the organization’s main business is managing projects). Project management research shows that projects need to be
categorised according to agreed parameters so that the methodology used to manage these projects can be adapted to suit the project type (Crawford et al. 2004, Shenhar and Dvir 1995, Turner and Cochrane 1993). The idea that one ‘size does not fit all’ is also reflected in recent papers published in project management journals.

Characteristics of complex projects have been classified in many ways: technical complexity (Jones et al. 1993), uncertainty of goals and methods (Turner and Cochrane 1993), differentiation and interdependency (Baccarini 1996), structural and technical complexity (Williams 1999), assembly, systems and array (Shenhar and Dvir 2007) and structural, technical, directional and temporal complexity (Remington and Pollack 2007). Some professional bodies such as the Australian Institute of Project Management <www.defence.gov.au/dmo/proj_man/AIPM_Presentation.pps> have formulated new competencies required by project managers to manager complex projects. There is some debate among academics and practitioners about whether aspects of projects are complex or some projects. (Whitty and Maylor 2007). In the meantime the Defence Materiel Organization (DMO in Australia has established a College of Complex Project Managers (recently renamed the International Centre for Complex Project Management) and an Executive Master of Business Management (Complex Project Management) has been established to develop complex project managers for defence procurement in collaboration with the Queensland University of Technology. Professional project management bodies such as the Project Management Institute and the International Project Management Association have shown an interest in complex aspects of projects although they have not revised their standards or started recommending different methodologies to address complex projects.
Complexity in IT projects:

The notion that IT projects are increasing in complexity is also found in the IT-related literature. McKeen et al (1994) propose two important complexities in information systems (IS) development: task complexity and system complexity. Both are related to uncertainty and ambiguity with task complexity arising from the business environment and system complexity arising from the developer’s environment. Ribbers and Schoo (2002) propose three dimensions of system development complexity. The first, *variety*, refers to the multiplicity of project elements such as the number of sites affected by the system implementation. The second, *variability*, refers to changes in project scope and goals. The third dimension is *integration* and refers to coordination between project elements. There are some similarities between the varieties of complexity mentioned in the project management literature and the information systems literature.

Jacucci et al. (2006) raising the importance of addressing complexity in IT projects in a special issue of *Information Technology and People* cite British Computer Society (2004)’s study that argues that current software development methods are unable to deal with increasingly complex IT projects. They suggest that IS scholars have to find ways to develop IT systems as a result of rising complexity of such projects due to changing market demands, process reengineering, workforce diversity, and globalization and social relations across organizational and geographic boundaries. In the same special issue of the journal Benbya and Mckelvey (2006) offer seven principles of adaptive success to deal with complexity in IT projects from foundational, biological and social science theories. Xia and Lee (2005) suggest that to improve the performance of IS development projects, an assessment of the key dimensions of project complexity needs to be done to understand how they affect project outcomes.
Using complexity theories to study projects

Several papers reviewed in the literature suggest the use of ideas from the complexity theories to understand the complexity of projects. Remington and Pollack (2007) point to some aspects of complexity theory -- the continuum between order and chaos, fitness landscape, sensitivity to initial conditions and complex adaptive systems. From the IT literature Benbya and McKelvey (2006) use ideas of complexity found in biological and social science theories. Singh and Singh (2002) use chaos theory to explain the behaviour of cost escalations in projects. Ivory and Alderman (2005) suggest that project managers can learn from viewing projects as complex bounded entities. They state that this can also help to understand project failure and the inadequacy of conventional project management methodologies. They advocate looking at projects as a process of constantly adjusting the project system to fit a confounding and emerging reality. They suggest that metaphors from complexity science can aid in the understanding of projects. Harkema (2003) recommends an understanding of complex adaptive system to understand the dynamic conceptualization and execution of innovation projects. Pich et al. (2002) suggest that project managers should study how project outcomes are influenced by the way they are framed at the initial stages (often mentioned in literature on complexity).

A brief review of the project management literature and IT literature discussing project complexity points to the need for more research into projects from a complexity theory perspective.

Applying complexity theory to organizations and management

At the suggestion of my supervisor I then studied the metaphors used in complexity theories to arrive at some lenses through which I could explore projects in my organization. The
metaphors that I considered after reading some books and papers on complexity are as follows:

1. Butterfly effect – how initial conditions have a disproportionate effect on the outcome or the Lorenz attractor
3. Dissipative structures and phase transition
4. Complex adaptive systems – the notion that order is emergent, systems history is irreversible and a system’s future is unpredictable.
5. Network theory – Randomness and probability

A study of complexity theories led to me to the application of complexity to organization and management through a series of books on complexity and emergence in organisations published by Professor Ralph Stacey and his colleagues from the Complexity and Management Centre at the University of Hartfordshire in the UK. Stacey and his colleagues (Griffin et al. 1998) suggest five causal frameworks to understand the complexity in organisations.

1. Natural Law Teleology – Moving toward a known state
2. Rationalistic Teleology - Moving toward a known state
3. Formative Teleology - Moving toward a known state
4. Transformative Teleology - Moving toward an unknown state
5. Adaptionist Teleology - Moving toward an unknown state

In natural teleology, a system moves in a stable manner towards timeless stability. The movement is predictable; the interaction of parts is immaterial. In formative teleology, the causality is of functional formative processes to reach a pre-given form. An extension to formative teleology is rationalist teleology in which causality is due to autonomously chosen goals reflected by universal ethical principles. In transformative teleology there is a potential
for transformation and continuity at the same time. This implies a form of self-organization that is paradoxical, characterized by both continuity and potentially radical transformation. Adaptionist teleology implies a chance-based competitive search for optimality with a weak form of self-organization confined to the selection processes. Stacey argues that the existing management theories propose solutions based on moving towards known futures either based on formative teleology or rationalistic teleology which is inadequate to explain complex situations.

I believe that the existing project management theories generally assume that a project outcome is known or will move towards a known state according to formative or rationalistic teleology. But this is not always the case with projects I have encountered in my organization. Therefore I want to look at such projects from a different perspective. I thought that since my organization executes many projects I have access to real projects that I can study to pursue my research.

**Researching project actuality**

Researchers who participated in a UK government-funded research project (Winter et al. 2006) point out that there is need for more research producing theory for practice by treating projects as social processes. Cicmil et al. (2006) also suggest that ‘a better understanding of *project actuality* focusing on *social processes* and how practitioners *think in action*’ could ‘contribute to more satisfactory outcomes of contemporary projects’. They suggest that interpretative and critical research methods, such as rich ethnographic studies and action research, could pave the way for co-authorship between scholars and practitioners combining ‘scholarly theorising’ and ‘practitioner’s narratives’. These research methods rely on ‘listening to practitioners and their interpretations of their own experiences and actions’ and ‘engaging in a critical dialogue with the practitioner who reflects and interprets their own experience’ (Cicmil et. al 2006, p. 677). Sauer and Rich (2009) discussing IT projects with
reference to the rethinking of project management based on Winter (et. al 2006) include complexity as one of the new mindsets.

I would like to propose that there is an opportunity and a benefit to develop an interpretive framework by studying the actuality of complex IT projects in my organization to develop better ways of managing such projects. This could benefit my organization as well as the project management community that is now urging practitioners to study how we think in action to develop new perspectives on projects.

The lenses

Based on a review of the literature as well my own observations of a real project I propose five initial lenses through which I will study projects in my organization. These lenses have been derived mainly from the work done by Stacey and his colleagues.

I will now present my view of what happens in some of the projects I have been working on using the language used in some of the literatures I have reviewed. While project objectives are expected to be initially defined, they actually change continuously during execution which is detected through sense making. The project team and organizational members act as knowledgeable agents, interacting with each other and self-organizing according to macro or micro changes. Macro changes are initiated from the organizational, market, industry or economic level. For example, the current recession can be labelled as a macro change. Micro changes are triggered by either agents or by the local operating landscape due to cooperation and/or competition. The project boundary within large organizations is created and erased by existing and ongoing processes. Every agent (project team member) undergoes changes while participating in the project and relaying changes to other agents and processes concurrently. Every agent has unique characteristics and contributes to collective effort in a spontaneous fashion which leads to emergence. Knowledge about the project is shared and constructed in a progressive manner. Such knowledge is codified in forms or symbols (project schedules, Gantt charts, and earned value analysis) and cultural reifications. During the execution of the project business process knowledge, technical knowledge and systems knowledge is shared and enhanced, by
participating agents. From this perspective project management can be considered to be a complex responsive process where communication is an important factor. The project stakeholders and organizational members interact by organising themes, for example the project manager always expresses concern about time or cost or quality while the technical architect uses themes such as design and operating constraints, and a project sponsor is often concerned about business benefits and customer experience. An outcome emerges out of these interacting themes on a constant basis. Therefore, themes become the main construct of the responsive process. In a project the themes are developed during the interaction and are context sensitive. My research aims to develop a framework by mapping these concepts to real-time projects.

I propose the following constructs or lenses to begin interpreting project management events in my organization.

1. Sense: This is a means to continuously interpret the project objective and purpose by different participating agents (stakeholders). I will look at the constraining and enabling nature of this theme at the inception of the projects. Using this lens will help me to study how the purpose of the project changes as a perpetual construction of reality.

2 Medium: This lens is to enable studying the themes occurring in a project using symbols, stories, narratives, metaphors, fantasies, and reifications. Using this lens will help me to show how project management tools (language, terminology, schedules, plans, memos, minutes of meetings, presentations, dash boards, control sheets etc.) are used to represent emerging themes including power differentials. This lens will enable a study of interactions in a projects and how they are interpreted in a context sensitive fashion by the agents.

3 Referential: This lens will help study recurring themes in a project such as ideology, culture, policies, mandates, dictums, statutes and directives. These will be studied through public conversations that happen in my organization. These themes direct the course of the conversation, constraining or enabling in nature. On occasions these are also challenged and not adopted or adhered to (leading to private conversations) by the agents. These can only be captured through informal
conversations. This lens will help to show how some of these recurring themes can lead to negative or limiting outcome of a project.

4 Relationship Dynamics: This lens will enable the study of intensive interaction of the project agents. It could point to the spontaneity, continuity and transformative nature of various themes as they emerge in a typical IT systems project. It is expected that this lens will help to examine positive and negative behaviours in a project environment. This will inform how heterogeneous agents in a project environment react to events in a dynamic fashion.

5 Identities. This lens will enable a study of agents and agency. This lens will help in looking at characteristics such as identity, image, power differentials, politicking, project landscape modulation, ethical issues, covert operations and enactment. These are shadow themes in a project environment often not noted.

I believe that a typology of projects needs to be developed based on complexity factors like structurally complex, technically complex etc as indicated above. The project patterns such as linearity, chaos, edge of chaos and disruption will be looked into as part of the research. The framework will also attempt to enlist prominent factors such as trust etc which propel the project from one pattern to another. These lenses will reveal the underpinning complexity. The framework proposed is interpretive in nature.

Research Methodology

The proposed methodology for studying projects in the organization is based on case study research. Each project studied will be considered as a case and all data collected from a case project (unit of analysis) will be used to interpret that project. According to Yin (2009) case study is a useful methodology when:

1. The type of research question is How? And Why? In this study I want to understand how and why complexity affects our understanding of projects.

2. There is limited control over behavioral events. This study is carried out in a naturalistic environment. So no attempt is being made to change the behavior of the participants.
3. Focus of research is on contemporary events. This research will study some real projects as they are being implemented. Although past projects will be examined via documents or interviews the main focus is on current projects or current views of managers who implement projects.

A variety of data is expected to be collected for this study which is also conducive to the study of cases. This will include project documents and records, participant observation and interviews.

A multiple case methodology will be used. Both old and current projects will be included in the case study. Four case studies will be initially selected from two categories of project: projects below A$ 500K which are considered small projects and projects above A $ 3Million which are classified as large projects. The reason for this selection is to examine whether small and large projects exhibit similar or different aspects of complexity. For each case four people at different levels – a project manager, a systems architect, a business manager and a team member will be selected to be interviewed. The following documents will be examined for each project:

1. Project management plans,
2. Project Schedule,
3. Risk Registers,
4. Issue Logs,
5. Steering Committee Report,

For current projects participant observation will be conducted over a six-month period, including participation in project meetings. Program managers who are responsible for these projects will also be interviewed.

Individual case and cross-case analysis will be conducted for each case. First, each case will be analyzed for themes using open coding, axial coding and memos. The sequence of analysis will be:

1. Single case analysis of small projects
2. Cross case analysis of all small projects.
3. Single case analysis of large projects
4. Cross case analysis of large projects
5. Comparison of analysis small and large projects.

Once all cases have been analyzed a presentation of the study will be made at a local project management association’s meeting and experienced project managers present would be invited to join a focus group to further discuss the findings. This will assist in triangulating the findings.

To ensure validity a research protocol will be developed as part of the human research ethics applications. A pilot case will be used to ensure that interview questions, observation templates and document reviews can be used as planned. Any ambiguous questions revealed in pilot interviews will be revised.

I expect that papers will be presented at conferences during the candidature to receive feedback from peers including future IRNOP conferences.

Ethical issues

The ethical issues expected are confidentiality of organizational information and emotional stress to people being interviewed or observed. The organization where this research is conducted will not be identified. The participants will also remain anonymous and pseudonyms will be used to ensure that people are not identified. Informed consent will be obtained prior to conducting any observations or interviews. The participants will be free to withdraw from the research if they wish. They can also withdraw from participating at any stage where they feel discomfort but would be expected to give some notice.

Limitations:

Since the research will be mainly conducted within my organization the generalisability from the findings would be limited. But the focus group will provide some cross-organizational inputs. The predefined lenses could add bias to the research. Along with my supervisor I will ensure that I remain open to finding other lenses that could be more useful to study complexity in projects.
Expected contributions from the research

This research is expected to contribute to project management theory by providing an interpretive framework for complex projects. It is expected to contribute to practice by helping project managers understand and handle project complexity especially for IT projects. It will contribute to policy by helping my organization to take a look at the limitations of current methodologies being used to manage projects and lead to better practices. The research will also contribute to case study methodology by demonstrating how using lenses derived from theory could be useful to collect data in case study research.

Conclusions:

IT projects are found to be exhibiting inherent complexity due to the interaction of people, organizations and systems in determining success or failure of such projects. The current normative project management methodologies are unable to cope with such complexity. A research project is being proposed to develop an interpretive framework for IT projects by studying real projects in a large organization providing telecommunication services. Five lenses have been derived from theory, and own experience and a pilot study to make sense of events occurring in real projects has been conducted with favorable results. A trial study that I carried out in my organization has confirmed that the lenses are able to be used effectively. It is expected that this research could be useful to both theory and practice of project management.
References:


