

The use of project management mechanisms
in software development
and their relationship to organizational distance:
An empirical investigation

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A dissertation submitted in fulfillment
of the requirements for the degree of
Doctor of Philosophy

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June 2005

CERTIFICATE OF AUTHORSHIP

I certify that the work in this thesis has not previously been submitted for a degree nor has it been submitted as part of requirements for a degree except as fully acknowledged within the text.

I also certify that the thesis has been written by me. Any help that I have received in my research work and the preparation of the thesis itself has been acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

Acknowledgements

No student research is possible without the help and guidance of supervisors. I was fortunate to have Professor Brian Henderson-Sellers and Associate Professor Didar Zowghi as my supervisors. Their guidance and encouragement was highly valued. In particular they curbed my tendency to race off in new and interesting directions.

Any endeavour that lasts for several years places added burdens on family and friends. I am grateful to my wife, Helen Allport, for the support and balance she provided. Numerous times she listened politely to obscure reasoning about something that could only be of interest to someone deeply involved in it. And let's not forget the gourmet meals.

This research depended on the willingness of active and busy project managers who gave up their time to be interviewed. It is ironic that the same privacy concerns that protect them also prevent their public acknowledgement and thanks. To all of you I extend my heartfelt thanks.

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Abbreviations, Acronyms

4GL	Fourth Generation Language
CMM	Capability Maturity Model
CMMI	Integrated Capability Maturity Model
COTS	Commercial Off The Shelf
CSCW	Computer supported cooperative work
ICT	Information and communication technology
IDE	Integrated development environment
IS	Information systems
IT	Information technology
PMBOK	Guide to the Project Management Body of Knowledge
PMIS	Project Management Information System
PSEE	Process-centred Software Engineering Environment
QA	Quality Assurance
RFP	Request for Proposal
SPICE	Software Process Improvement and Capability dEtermination
TQM	Total Quality Management

Abbreviations, Acronyms, Glossary

Glossary

Adverse selection	<p>A transaction in which the seller has relevant information that the buyer does not have, or vice versa. Also refers to the tendency for buyers or sellers to exploit these asymmetries in information to their own advantage. For example, someone with a dangerous occupation or hobby may be more likely to apply for life insurance.</p> <p>www.agtrade.org/defs.cfm</p>
Contingency	<p>A term used to identify the few factors that significantly affect outcomes. For example, organizational contingency theory examines the fit between a few variables, usually risk or uncertainty, and organization structure (Lawrence and Lorsch, 1967; Mintzberg, 1979; Perrow, 1986). In statistical terms, the variables would properly be called “mediating variables”. A common term in popular usage is “critical success factor” with the acknowledgement that a contingency or mediating variable is not necessarily associated with success. This term is discussed in Section 2.1.2.</p>
Control	<p>To exercise restraint or direction upon the free action of; to hold sway over, exercise power or authority over; to dominate, command. Oxford English Dictionary Online.</p> <p>In the context of software development project management it is to restrain and direct activities to achieve the projects goals.</p>
Coordination	<p>Coordination has been defined as the direction of "individuals' efforts toward achieving common and explicitly recognized goals" and "the integration or linking together of different parts of an organization to accomplish a collective set of tasks" (Kraut and Streeter, 1995).</p> <p>Managing the dependencies between activities. (Malone and Crowston, 1994)</p> <p>Managing the distribution of tasks among those who will perform various activities to perform those tasks, then managing the resources and activities to produce the component parts of the product so that they integrate into a complete whole.</p>
COTS	<p>COTS is an acronym for Commercial Off The Shelf. It refers to hardware and software systems that are manufactured commercially and then tailored for specific uses. This is in contrast to systems that are produced entirely and uniquely for the specific application. (http://en.wikipedia.org/wiki/COTS accessed 19 July 2004)</p>
Emergent property	<p>Characteristics that emerge at a level of a system hierarchy but which do not appear at the level below it.</p> <p>Emergent entities (properties or substances) ‘arise’ out of more fundamental entities and yet are ‘novel’ or ‘irreducible’ with respect</p>

Abbreviations, Acronyms, Glossary

	<p>to them. Stanford Encyclopaedia of Philosophy</p> <p>In systems that are sufficiently complex, properties emerge that cannot be reduced to the constituent elements of the system.</p>
Governance	<p>The act or manner of conducting the policy and affairs of an organization; the control or influence of people; constituting a rule, standard or principle.</p> <p>www.vcn.bc.ca/volbc/tools/glossary.html</p> <p>The action or manner of governing (see senses of the vb.); the fact that (a person, etc.) governs. Oxford English Dictionary</p>
Horizontal coordination	<p>The extent to which coordination is undertaken through mutual adjustment and communication between users and IS staff (Nidumolu, 1995).</p>
Mechanistic coordination strategy	<p>Coordination achieved through formal, controlling and centralised means (Shenhar, 2001; Andres and Zmud, 2002).</p>
Monitor	<p>To observe, supervise or keep under review; to keep under observation; to measure or test at intervals, especially for the purpose of regulation or control. Oxford English Dictionary Online</p>
Moral hazard	<p>The risk that a party to a transaction has not entered into a contract in good faith, has provided misleading information about its assets, liabilities or credit capacity, or has an incentive to take unusual risks in a desperate attempt to earn a profit before the contract settles.</p> <p>www.frbsf.org/tools/gloss.html</p>
Organic coordination strategy	<p>Coordination achieved through informal, decentralised and cooperative means (Shenhar, 2001; Andres and Zmud, 2002).</p>
Organizational distance	<p>A measure of the cultural, structural and administrative separation between different members of a project team. This term is described more fully in Chapter 3.</p>
Outsourcing	<p>Obtaining goods or services from an outside (the organization) source. Oxford English Dictionary.</p>
Vertical coordination	<p>The extent to which coordination between users and IS staff is undertaken by authorized entities such as project managers and steering committees (Nidumolu, 1995).</p>

ABSTRACT

This thesis describes empirical research into project management of software development. Specifically, the aim of the research is to investigate how project managers monitor, control and coordinate software development tasks and how this is affected by changing environments, in this case increased organizational distance between the project manager and elements of the project team. Differing project environments allow investigation into which project management mechanisms are essential, which are required in specific circumstances and which may be useful but not necessarily essential.

To explore how software development projects are monitored, controlled and coordinated, a broad range of literature from software development and other fields such as organization theory, supply chain management and automobile manufacture is examined to establish a consensus of the mechanisms of project monitoring, control and coordination and their classification into groups. To better understand how the different mechanisms may be selected in different circumstances, a range of contingencies is examined to deduce which of these contingencies may significantly affect the project management of software development projects.

Outsourced and distributed software development projects are becoming more frequent than in the past with consequent effects on project management practices. Although there has been some research into the ways in which project managers monitor, control and coordinate software development projects, little of it has investigated how the mechanisms employed to do so may be affected by such factors as increasing organizational distance. If more were known about the ways in which changed project environments affected the selection and use of project management mechanisms, better responses to those environmental changes could be devised. This could also identify where tools could be developed to assist project management of outsourced and distributed projects.

In this research, the term 'organizational distance' is used to describe the cultural, structural and administrative distance between the project manager and elements of the project team. Since there is limited information available on the concept of organizational distance, a new model is developed that encompasses the dimensions of distance that may be found in outsourced or globally distributed projects. A second model is then developed that relates changes in the factors of organizational distance with preferred choices of project management mechanism via project contingencies.

Empirical data were collected by structured interviews with project managers who were currently engaged in software development within Sydney, Australia. The method of collecting

Abstract

the data provided both quantitative and qualitative data that enabled three separate ways to investigate the research questions.

The empirical research found that project managers do not rely on a single mechanism to monitor, control or coordinate a software development project but employ multiple mechanisms. While the portfolio of mechanisms for both monitoring and control comprised a relatively narrow selection, the portfolio of coordination mechanisms was more diverse.

Project monitoring mechanisms were employed to first detect any project problems then to respond to those problems. This contrasts with monitoring systems designed to provide all the information about both the existence and probable causes of project problems.

Project control mechanisms reflected the origin of the control. The constraints imposed on the project by the organization and used by the project manager to direct the project tended to be outcome related, for example budget and schedule. The behaviour of the project team, even across significant organizational distances, was controlled through the use of project plans that determined when different tasks would be performed.

Project coordination mechanisms reflected the different types of dependencies between software development activities. The most common was using a project work breakdown structure, expressed in the project schedule, to resolve sequential and pooled resource dependencies. Mutual dependencies tended to be resolved using interactive mechanisms such as co-location, conversations and meetings.

The empirical evidence did not find any difference between co-located projects and distributed projects so far as the choice of project management mechanisms were concerned. Distributed and globally outsourced software development projects may encounter many difficulties that a fully co-located project does not, but the response to those difficulties appears to lie with the implementation of project management mechanisms and not their selection.