Towards Improved Project Management Practice

Uncovering the evidence for effective practices through empirical research

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Abstract

Projects are important to industry, but project performance continually disappoints stakeholder expectations. Organizations react to this performance problem in many ways, and purchase consultancy, training, methods and tools as possible solutions.

There is no published evidence that any of these solutions are consistently successful in improving project performance. This thesis answers the question, "What can be done to improve project management practices, and thus project performance?", by demonstrating that a novel form of continuous action research can contribute such evidence.

Firstly a community of practice was formed from practitioners with major corporations interested in answering the question, and commercially motivated to implement changes. A programme was developed that centred around project management, but linked to project and corporate performance and success.

A well-resourced support structure was established to administer the programme, facilitate dialogue, hold confidential data securely, and provide data analysis. Members provided data for the anonymous databases about their practices and about specific project results, and first-hand case studies for discussion at workshops. They discovered, shared and created both tacit and explicit knowledge through the formal programme and through informal contact.

Secondly, the thinking of practitioners, theorists and researchers was challenged. The literature on project management was found to reveal an unbalanced worldview that lacked coherent underlying theory. The literature on theory was found not to distinguish adequately between one-off “discrete” projects and the ongoing continuous operations of an organization. The academy’s “paradigm wars” were found to have discouraged the creation of an appropriate research methodology.

Thirdly, different pieces of research using the community’s data showed that some practices (notably aspects of risk management) lead to superior performance independently of context, while others appear to be context-dependent. No companies were found to have all the answers, and each member of the community has been able to learn from others.

Dedication

This work is dedicated to two remarkable women. Doreen, my wife, without whose constant support I would not have stayed the course, and Nora, my mother, who made great sacrifices to give me the foundation of my education.

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Summary of Thesis

This thesis describes a programme of continuous action research, involving an international network of major organisations to which projects are important. The research concerns the development of methodology and content to build this network into a learning community for project improvement. The research started with six quite basic questions about project management practices but it has led to significant developments in: -.

- A research-driven approach to project improvement.
- An innovative research method.
- Enhancement of the existing project management worldview.
- A growing international network of project-based organisations.
- Specific results that pave the way for project management benchmarking.
- A means of relating project performance to business improvement.

The thesis contains six Chapters.

Chapter 1 describes what projects are and the role they play in business, and explains why the research questions are important.

Chapter 2 reviews the corpus of project management literature, and extracts an account of the way a project manager views the world. This view is consolidated into eleven topics and given a form and substance that shows how they inter-relate. Comparison with prior empirical research identifies a number of gaps.

Chapter 3 considers the epistemic foundations for a research method that has seven explicit components, making allowance for the fact that neither a pure positivist nor a pure constructivist philosophy provides a sufficiently rich basis to research into project management.

Chapter 4 traces the historical development of the seven components of the research method, and summarises the answers to three of the research questions.

Chapter 5 illustrates the results obtained from data analysis, answering a further two research questions by describing both observed variations in project performance, and practices that partially account for these.

Chapter 6 summarises the contribution made by the research programme, and lists the current plans for further work.

Contributions

In the course of this research, two things have been happening in parallel. One has been the commercial creation and support of a network of major organisations to improve project management practice. The other has been the development of research in terms of both methodology and content, which has transformed that network into a learning community. It is this research, quite separate from the commercial activities, that is submitted for the degree.

The original research concept came to me during 1993, at a time when I saw many organisations making far-reaching decisions about their project management practices with very little evidence to support them. I was driven by the desire that decisions should be based on the foundations of solid evidence, and to create a method for obtaining that evidence.

My personal contributions to the programme have been in:-

- Developing the conceptual design of the study, including the overall process steps and the epistemic underpinnings described in Chapter 3, the method of choice that was used for significant decisions, the structure of all workshops involving network members during the first few years, the structure of all analysis carried out and reports issued, and the commercial relationships between network members and Human Systems Limited.
- Developing the analytical framework and performing analysis on the data, as well as directing additional analysis from time to time from members of Human Systems working under my instructions.
- Formulating theories that have guided each stage of the work.
- Assembling and maintaining the networks, or ensuring that suitably qualified members of the Human Systems team working under my instructions, assemble and maintain the networks.
- Facilitating the dialogue that results in agreement on the information to be collected from the networks and the form that it will take, and obtaining agreement for this from network members.
- Ensuring that data is collected, and assuring its quality.
- Facilitating the discussion between network members and members of the Human Systems team that result from the announcement of

insights arising from the analysis, and the framing of more detailed research questions as a result of these discussions.

- Writing all research proposals and submissions, including the whole text of this thesis.

Clearly I could not have done this work without the support of many people, and I wish to acknowledge the assistance received from the following. Throughout the programme, I have received the financial and practical support of Human Systems Limited, the company of which I am Managing Director.

My colleagues at Human Systems Limited have each been involved in different aspects of the programme. John Gandee, one of the first people to be approached at ICL when the idea of forming the community was first mooted in 1993, has been continually involved. From the output of the initial workshops he wrote the first version of the corporate practice questionnaire, he has attended each of the workshops for and performed much of the management activity involved in supporting and administering the work of the first two networks, and more recently he has produced the Foxpro version of the corporate practice questionnaire and its derivatives, and has overseen and augmented development of the commercial Access version of the DCI. John facilitated the first working party on “learning lessons on projects”.

Brian Trefty, the first representative of Wellcome in the first network, has subsequently been a stalwart member of the Human Systems team. It was largely through Brian’s effort that the joint venture with CMR International came about that has resulted in the creation of two global pharmaceutical networks. Apart from leading that effort, Brian has worked closely with John Gandee in the creation and support of Europe 2, the second network to be created. He has facilitated working parties on “real risk management” and “implementing process improvements”. Alan Cumberland, a fellow Director of Human Systems Limited has continually supported the venture, and played a significant part in decisions about the management of the commercial aspects of the programme. Alan has facilitated several of the network’s workshops, and the working party on “measuring project performance”. Jean Adams, Matthew Nixon and Debbie Garrett have also provided generous and professional support to the activities, in addition to which

Jean very kindly assisted with the unenviable task of proof reading this text.

As the networks took on an international aspect, Lynn Crawford, Frank Davies, Chivonne Watts and Andrew Durbridge headed the effort to create commercial networks and to apply the research method in Australia, and did an excellent job in recruiting thirty additional organisations. Lynn has provided valuable encouragement and support to me and to the Human Systems team, and Frank has been tireless in his professional efforts to assemble and support the Australian community, and to manage the network activities based in Sydney. As the programme rolls out to USA, Dalton Weekley, Peter Rogers and Steve Neuendorf of CCG LLC have become joint venture partners, and Steve has contributed the excellent Excel spreadsheets that enrich the presentation of relative data to members of all current networks.

The programme has been built around a “community of practice”, and it would not have been possible without the active participation and support of the representatives of the many organisations that have been members of the networks since their inception at the beginning of 1994. They have been generous in their provision of time, data, knowledge, expertise, resources and support. It is wrong to single out some more than others for mention by name, since many have made invaluable contributions, and I would like to acknowledge every one of them. It would equally be wrong, however, to fail to acknowledge the special contribution made by two people. In the early days of creating the first network, Steve Grey of ICL worked tirelessly with me to assemble the first community of practice, and to refine the proposal that was put to prospective members. Without Steve’s help, I doubt that the programme would have got off the ground. Paul Armstrong and his team at BT Group Projects have also made a unique contribution. Not only has Paul been continually associated with this activity as BT’s representative since the formation of the first network, but in the development of the data collection instrument, Paul and his team took the lead in developing the prototype Microsoft Access application, that was subsequently refined by commercial software developers into the instrument that it now is.

Finally, I would like to express my heartfelt appreciation for the unstinting guidance, encouragement and support of my supervisor, Professor Eric Wolstenholme.

Confidentiality

There is a commercial need to protect the confidentiality of information provided by members of the networks. For this reason, the data and other material included in the thesis have been presented in such a way as to protect the interests of the network members after this thesis has been published.

Terry Cooke-Davies. August 2000.

Chapter 1:

1: Thinking about projects and project management.

1.1 Summary.

The term “project” is used widely and in a variety of contexts, and a technical vocabulary has grown up to describe different aspects of projects. Industry throughout the world today uses the concept of a “project” to talk about particular kinds of work (generally unique, self-contained pieces of work that are intended to create a product or service that will lead to beneficial change), and this kind of work is of great economic and social importance. The development of the concepts and language about projects is considered briefly in relation to its social and economic environment throughout history and in the present day, before the present worldview held by private sector commercial and industrial organisations is sketched out in relation to projects. The question of how these organisations measure the performance of projects is introduced, and it is shown that there is a widespread perception that many projects “fail”. The social and economic cost of this failure is reviewed.

1.2 What projects are and what some key terms mean.

The literature of project management offers a variety of definitions, which have classically included the three characteristics of a common objective, a set of activities that are complex enough to need managing, and a defined start and finish time.

> *A complex effort to achieve a specific objective within a schedule and budget target, which typically cuts across organisational lines, is unique, and is usually not repetitive within the organisation. (Cleland and King, 1983, p.70)*

More recently, definitions have been modified to reflect the existence of a “product” or “service” that the project creates.

> *A temporary endeavour undertaken to create a unique product or service. Temporary means that the project has a definite ending point, and unique means that the product or service differs in some distinguishing way from all similar products or services. (Duncan, 1996, p. 4.)*

Rodney Turner develops this theme even further, by including the concept of the "beneficial change" that the product of the project is supposed to deliver.

> *An endeavour in which human, material and financial resources are organised in a novel way, to undertake a unique scope of work, of given specification, within constraints of cost and time, so as to achieve beneficial change defined by quantitative and qualitative objectives. (Turner, 1993, p. 8.)*

One in particular, however, illustrates just how widely the term "project" can be applied in common parlance:-

> *Any plan, scheme or task - including the writing of this book - can be and is referred to as a "project". (Stallworthy and Kharbanda, 1983, Preface.)*

In order to provide appropriate boundaries for the definition of what a project is, it is perhaps appropriate to approach the topic from the other end, as it were, and ask the question, "What kinds of endeavour cannot legitimately be regarded as projects?" That yields very different answers, and in practice, they seem to boil down to four different categories:-

1. Sets of activities that are <u>repeated indefinitely</u>, such as the continuous operations of a process plant. These are perhaps more usefully thought of as "*processes*".
2. Sets of activities that are <u>repeated in a predictable manner</u>, such as batch manufacturing, the raising of invoices, or the conduct of annual appraisals. These can be thought of as processes, but can equally well be thought of as "*operations*" in the business context.[1]
3. Sets of activities that may well include projects, but which are sufficiently <u>large and complex</u> and have sufficient <u>flexibility about</u>

their start and finish that they are better thought of as "*programmes*".

4. Activities that are so brief, so simple or so straightforward that they require no significant management effort, and that can better be thought of as *tasks* or *activities*.

Figure 1 illustrates the relationships of these different elements.

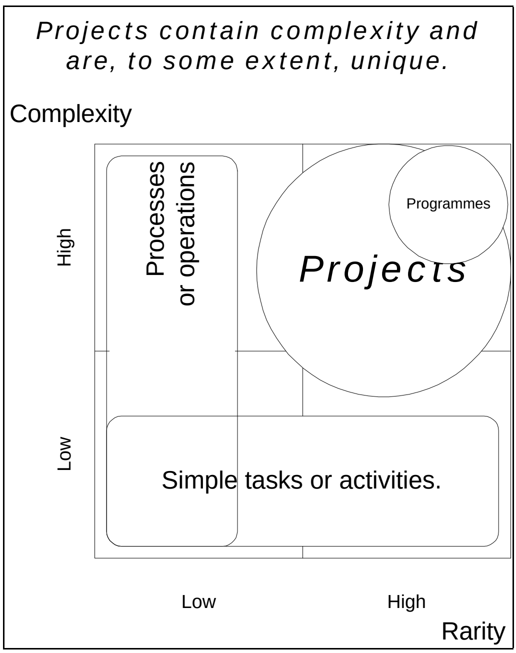

Figure 1: Where projects fit into the spectrum of work.

It seems clear that there is no chance of reaching universal agreement on a single definition of a project, but it is important to be clear about the meaning of a word that is so central to this piece of research. The stance taken in this research, therefore, is to adopt a pragmatic approach and recognise that thinking about an endeavour as a "project" is a matter of choice for any organisation or individual. Adding this recognition to the classical definition, and the concepts included by Duncan and Turner, the definition of a project used throughout this work is:

"A human endeavour may legitimately be regarded by its stakeholders as a project when it encompasses a unique scope of work that is constrained by cost and time, the purpose of which is to create or modify a product or service so as to achieve beneficial change defined by quantitative and qualitative objectives."

This research programme has been undertaken in order to identify how the performance of projects can be improved through the identification and understanding of those project management practices that lead to superior performance. It is essential to understand what is meant by several terms that will be used throughout this document, and in particular to distinguish what project management is taken to mean and what it isn't. Three concepts lie at the heart: -

a) The product or service that will be brought into existence or modified through the agency of the "project", and that will remain after the project has been completed will be referred to throughout this text as the **PRODUCT** of the project. This applies to any or all of the purposes of projects described above.

b) The series of activities carried out by people or their agents directly to create or to modify the product will be referred to throughout this text as **PROJECT EXECUTION** activities.

c) The series of activities carried out by people or their agents to initiate, plan, control and terminate the project execution activities will be referred to throughout this text as the **PROJECT MANAGEMENT** activities.

The distinction between project execution and project management is not always a neat and clear one. For example a meeting of site personnel in a construction project might be considered to fall into either or both of these categories. Nevertheless, the distinction remains broadly valid, and presents special problems for the use of techniques such as benchmarking for the assessment of project management efficiency or effectiveness (see Chapter 4).

1.3 The importance of projects to industry.

In business and commerce, projects represent a substantial proportion of the productive effort of enterprises in every industrial sector. A "straw poll" of fifteen enterprises recently estimated conservatively that their combined annual spend on projects exceeds £15bn.[2] The range of products that are created or modified by projects gives some indication of the extent and value of project work to industry, and of the beneficial change that projects achieve.

- New facilities are produced - factories, offices, plants or pieces of infrastructure. These are then operated for economic advantage.
- New products are designed or developed for manufacture in ongoing operations or for use to generate wealth in some other way.
- Services are delivered, such as the refit of a ship, the renovation of a building or the conduct of a piece of research.
- Changes are engineered to business systems and to organisation structures, so that enterprises can be operated more efficiently.

It is no exaggeration to say that projects lie at the heart of human economic activity, and it follows that any improvements that can be made to the practice of managing projects will have a significant effect of the output of all wealth creation in advanced industrial or post-industrial societies.

1.3.1 The conceptual basis to project management.

Very few of the published works on project management make explicit the philosophical approach that underscores their work. Most writers seem to imply that some form of empirical realism is possible. Some describe project management as a science or suggest that it uses “scientific” techniques, as for example Kharbanda, Stallworthy and Williams (1980) who define cost engineering as “that area of engineering principles where engineering judgement and experience are utilised in the application of scientific principles and techniques to problems of cost estimation, cost control, business planning and management science.” (p. 5)

Morris (1994) states that “there is not yet an adequate conceptual basis to the discipline [of project management]”, and concludes that “the current formal view of, and indeed practices of, project management are often inadequate to the task of managing projects successfully; and that we would do better to enlarge the subject to the broader one of the ‘*management of projects*’” by including topics such as “design and technology management, the management of political forces (governmental and non-governmental, and 'political with a small p' -

business, labour and community), cost-benefit management and the raising and management of the project's finance, the management of the timing or phasing of the project (something quite different, incidentally, from the theory and practice of project scheduling), and even contract strategy and administration." (p. 2)

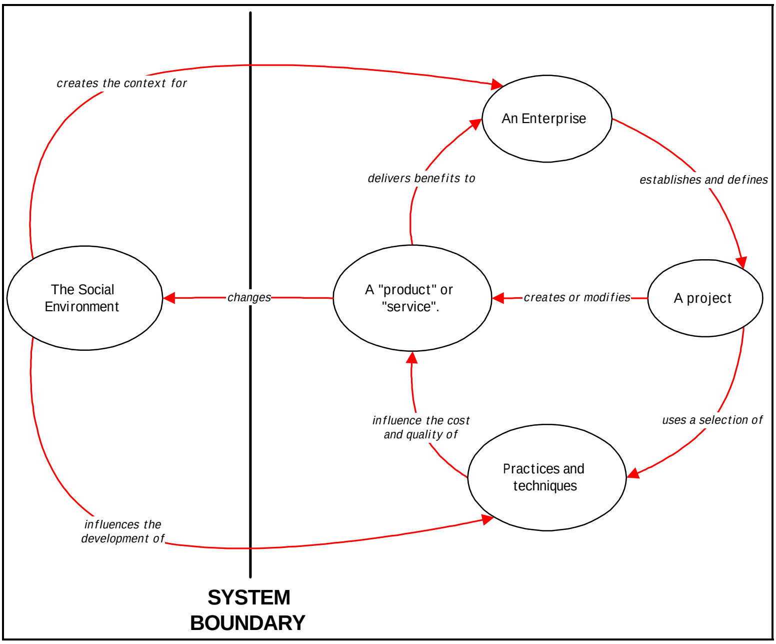

Figure 2: The context for projects.

One way to provide a framework for an "adequate" conceptual basis is to recognise the dynamic linkages that exist between an enterprise, the projects it undertakes, the practices and techniques it employs, and the products or services that are created or modified by the projects (See Figure 2 above). To include the full range of topics that Morris believes to have an influence on the performance of projects, however, it is also necessary to recognise that this activity takes place within a social and economic environment that creates the context for enterprises, that itself is changed by the products or services created by projects, and that exerts a strong cultural and technical influence on the practices and techniques employed in the management of projects.

A second way in which this research will seek to add to the conceptual basis to project management is by seeking to bridge the gap between "academic knowledge" and "industrial practice". As one leading management thinker has expressed it: -

> *Specialisation is becoming an obstacle to the acquisition of knowledge and an even greater barrier to making it effective. Academia defines knowledge as what gets printed. But surely this is not knowledge; it is raw data. Knowledge is information that changes something or somebody - either by becoming grounds for action, or by making an individual (or an institution) capable of more effective action . . . . Who or what is to blame for the obscurantism of the learned is beside the point. What matters is that the learning of the academic specialist is rapidly ceasing to be "knowledge". It is at its best "erudition" and at its more common worst mere "data". (Drucker, 1989: 251 – 252)*

1.4 Project management in its social and economic environment.

Although this work is not about the history of projects, modern project management is built on foundations nearly as old as civilisation itself. Key concepts that are still used today have emerged from the very different social and economic environments of different historical times, and have become part of today's "accepted wisdom" of project management.

A brief review is appropriate of how these key concepts and "tools" arose within their social context (see Table 1), so that the contribution of each of them to project management practice can be examined. In later Chapters serious questions will be asked about the effectiveness of each of them, and their relevance to today's business environment.

There have been a number of attempts to summarise the history of projects, and the introduction to many books on project management contains its own brief summary. The one that has exerted the greatest influence on this work is that by Morris (1994), although the four broad periods that will be considered below, along with the project management legacy from each of them, are not those used by him.

1.4.1 Projects in a pre- and proto-capitalist society (before c.1850).

Writers on the subject of project management are agreed that activities that could be described as "project management" date back to very early times in the history of civilisation. "Projects have been part of the human scene since civilisation started." (Lock, 1987) "Managing projects is one of the oldest and most respected accomplishments of mankind. We stand in awe of the achievements of the builders of the pyramids, the architects of ancient cities, the masons and craftsmen of great cathedrals and mosques; of the might and labour behind the Great Wall of China and other wonders of the world." (Morris, 1994, p. 1.)

One characteristic of these very early projects was the use of huge amount of manpower in what would today be called "the construction phase", and this "workforce" appears to have been organised in a way that reflected the social constructs of the culture in which the projects were taking place. Many early edifices had a religious connotation, and some (e.g. Stonehenge) may well have included large elements of voluntary labour. Others, such as the pyramids of Egypt, made use of large quantities of slave labour under the oversight of an architect.

The subdivision of manpower into smaller units for the purposes of oversight appears to have been well established in the ancient world. The first recorded reference to a supervisor dates from c.1750 B.C. (Wren, 1994). The term is frequently used in connection with the Egyptian "rule of ten" (whereby one supervisor is placed in charge of ten slaves or workmen) and an early text from the Bible[3] (dating from perhaps 650 B.C. and referring to some 500 years earlier) illustrates the principle of establishing a management hierarchy with a reasonable span of control. This has been one of the most enduring management principles, and has been applied in both military and civil life right down to the present day.

In addition to the labour element, the role of "contracts" was also important. Nearly all these early construction projects were let under contract to a single "contractor", who in turn would often let "sub-contracts" for various elements of the work. "The Long Walls in Athens, for example, were managed as a whole by the architect Callicrates, with the work let to ten contractors; the Colosseum was built by four contractors." (Morris, 1994, p. 4.). Even where the "contract" was less formal, a Pharaoh such as Rameses II (c. 1270 B.C.) would contract the oversight of his major building works to his vizier and Royal Architect Rahotep. (Rohl, 1995)

Throughout the era of Classical Greece and Rome and continuously through the growth and domination of the Christian Church, projects continued to be undertaken to construct the great "public works" required by society.

As first the enlightenment, and then industrialisation began to mould the social context, and industrial and commercial enterprises began to act as agents for society at large, the number of projects, and the fields of human endeavour within which they were undertaken began to proliferate. The predominant context, however, within which projects were undertaken remained the areas of building and civil engineering, with a dominant format comprising "the professional designer 'representing' the owner's interests in preparing a design and awarding and administering the contract between the builder and the owner." (Morris, 1994, p. 6.)

Social Environment	***Emergent concepts***
1. Projects in a pre- and proto-capitalist society. (before c.1850).	a) Mobilisation and management hierarchy. b) Client-contractor relationship
2. Projects and project management in a world dominated economically by "classic capitalism". (c.1850 to c.1950) Evolution of formal techniques.	c) Management disciplines d) Project planning techniques. e) Logistics planning. f) Work breakdown structure. g) Time-driven research.
3. Projects and project management during the era of "managerial capitalism". (c.1950 to mid-1980s) Birth of a profession. Widespread adoption of project management by the engineering and construction industries in the 1970s. Early application of project management techniques in other industries such as IT and Entertainment. The expansion of project management from "traditional" environments into strategic business management and IT during the 1980s.	h) Systems management. i) Scheduling techniques. j) Procurement management. k) Performance measurement (Earned Value Analysis). l) Programme management. m) Project management professional societies. n) Project matrix organisations. o) Refinement of defence development life-cycles. p) Widespread acceptance of project management practices. q) New forms of contract - BOO (T). r) Macro-technology programmes. s) Application of project management to IT projects. t) Systems engineering and software project management.
4. Projects and project management during an age of "intellectual capitalism". (mid-1980s and beyond). Project management as a "core business discipline": The current trend towards the "project-based organisation" and "management by projects".	u) Business process re-engineering. v) Project-based organisations. w) New contract philosophies (Partnering, Alliancing). x) Attempts to apply "Benchmarking" techniques to projects

Table 1: Origins of elements present in current project management practice.

1.4.2 The era of classic capitalism: project management from c.1850 to c.1950.

By the beginning of the twentieth century, the shape of modern economic activity was in full swing in many Western countries, with engineering and construction projects making a major impact on the environment. Unlike earlier periods, however, at least three characteristics marked the social environment for projects during this period:

1. The existence of a market economy, in which commercial motives dominated the thoughts of both the owner (such as the Great Western Railway company) and the professional designer (such as Brunel).
2. Massive increases in the rate of technological development, and, with it, the establishment of a physical infrastructure that increased both the opportunities for and the complexity of project management.
3. The parallel development of management theory and practice as the search for industrial efficiency gathered pace.

Technological developments such as the railway, the motor car and the wireless telegraph played their part in shaping both opportunities for and the complexities of project management, and the products created by projects themselves helped to develop the infrastructure within which the projects themselves were carried out.

The pressure of market forces led to pioneering work by such management thinkers as Henri Fayol and Frederick Taylor which laid the foundations for much modern management practice. Fayol's principles and elements of management (Fayol, 1949), and Taylor's Scientific Management (Wrege and Greenwood, 1991) both had a great influence, the former on the "art" of management and the latter on the development of "scientific techniques".

Not only did many of the thought constructs emerge that underpin modern management practice (it is not uncommon to find text books published since 1990 that still enumerate Fayol's five elements of management — planning, resourcing, commanding, co-ordinating and controlling — as the basic tasks of management) but under these compelling economic conditions, engineers such as Henry Gantt developed tools that allow project work to be better planned. The eponymous Gantt chart is probably still the most widely used management tool today for communicating a project schedule.

The Second World War and its immediate aftermath brought the classical era to a close. The planning of military operations bears more than a slight resemblance to the planning of projects, but the only real advance that the military in World War II can claim to have made to the practices of project management is in the increasing sophisticated planning of logistics (getting the right resources to the right place at the right time and in a form where they are useful).

Perhaps the most significant legacy of the Second World War was in the developments associated with the conduct of major technological research against tight timescales, culminating with the Manhattan Project (the USA's development of the atomic bomb). The characteristics of this massive undertaking (involving over 600,000 people and costing over $2bn) were urgency and technical uncertainty, combined with the need to co-ordinate a wide range of activities in multiple locations.

The person in charge of the Manhattan Project was General Leslie M. Groves, and he attributes the success of the project to five factors.

> *Firstly we had a clearly defined, unmistakable, specific objective…. Second each part of the project had a specific task. These tasks were carefully allocated and supervised so that the sum of their parts would result in the overall accomplishment of our overall mission … Third, there was positive, clear-cut, unquestioned direction of the project at all levels. Authority was invariably delegated with responsibility, and this delegation was absolute and without reservation…. Fourth, the project made maximum use of already existing agencies, facilities and services… Consequently, our people were able to devote themselves exclusively to the task at hand, and had no reason to engage in independent empire building. Fifthly, and finally, we had the full backing of our government with the nearly infinite [availability of resources]. (Morris, 1994, p. 17.)*

Although much of this makes use of management principles developed during the era as a whole, the combination of factors quoted by Groves describes the principles on which the more recent practice of employing a "Work Breakdown Structure" is based.

1.4.3 The era of "managerial capitalism"[4]: project management from c. 1950 to the mid-1980s.

The prolonged period of post-war development, and its transition into the modern "information society" has been referred to as the period of "managerial capitalism" because it is marked by a growing separation of business ownership from management, with professional managers increasingly dictating the practices and the focus of business enterprises.

For project management it was a heady period seeing the birth of a profession (that of project manager), the widespread adoption of project management principles and practices by the engineering and construction industries during the 1970s, the early application of project management techniques to other industries such as IT, Entertainment and Services, and finally during the 1980s the wholesale expansion of project management from its "traditional" environments into the mainstream of business management and IT.

The first decade of the period saw the introduction and development of "Systems Management" — the "elaboration of the specification for the technical, organisational, cost, time and other parameters of a system (and hence its subsidiary programmes and projects) and the subsequent management of the planning, design/engineering, procurement, implementation and testing of the work needed to realise the system concept." (APM, 1995, p. 9.).

Growing through USAF procurement activities, it took root in the Atlas and the Polaris missile programmes. In the course of the last-named of these three, one of the most visible and (at least in its derivatives) widespread techniques of project management was developed. PERT (Program Evaluation and Review technique) combined the concept of linking activities together in a network that showed their logical dependencies, the combination of estimates of the likely duration of activities from bench engineers using a mathematical formula for determining the expected time of achieving a particular event, and the identification of the 'critical path', i.e. the sequence of activities in a project that requires the longest time for completion. (Morris, 1994).

At the same time as the US defence industry was leading the way in the development of Systems Management and PERT, construction industries on both sides of the Atlantic began to apply the principles of Work Study and Operational Research to recurrent projects such as plant maintenance or plant shut-down. From this work, most influentially through Du Pont, an alternative set of tools emerged, known collectively as CPM (Critical Path Method). There are many similarities between the two approaches, and both use a form of network diagram in which activities are represented by arrows with the logical dependencies of one activity upon another shown by the relationships between the arrows. On the other hand, there are also differences since CPM (which deals with activities whose duration can be estimated more predictably that the R&D environment of PERT) emphasises cost and resource allocation as well as schedule, whereas PERT is more concerned with predicting the likely duration of an uncertain project.

These developments gave rise to the article that classically defined the role of the project manager (Gaddis, 1959). In it Gaddis pulled together some of the concepts that still lie at the centre of project management: the primacy of objectives, the need for organisation, the unique characteristics that distinguish projects, the unique functions of a project manager — "the man in between management and the technologist" — and the necessary qualifications for success.

As the 1950s gave way to the 1960s and project-based activity increased not only in the defence and construction industries but also in the emergent world of computer, a second family of techniques grew to rival the PERT/CPM approach. Originating with Professor B. Roy's "Method of Potentials" in France (Roy, 1962) but described as a generic approach by Joseph Moder and Cecil Phillips (Moder and Phillips, 1964), this method differs from PERT/CPM in that it represents each activity by a box rather than an arrow, and then links the activities together by means of arrows. This allows the concept of "lag" to be used, showing the extent by which one activity lags behind another. Although it was slow to spread, this family of methods is now more widespread in common use than PERT/CPM.

During the early 1960s a study published jointly by the Department of Defence and NASA (DoD and NASA Guide, 1962) not only emphasised the need to include cost control aspects in PERT, but also introduced the formal adoption of Work Breakdown Structure as a tool for project and programme management. Shortly afterwards, the USAF specified that a specific form of PERT/Cost planning should be used, that related the physical progress of the project to the development of both schedule and cost. This technique, known as Earned Value, was a specific form of performance measurement that is now in widespread use in traditional environments for project management.

The 1960s (although not only the 1960s) were characterised by major cost and schedule overruns on high-visibility projects, with notorious examples such as the TSR2 project in UK leading to, on the one hand, a focus on the acquisition process in general and alternative forms of contract in particular, and, on the other hand, to a broadening of the application of project management into wider areas than the aerospace, defence and construction industries that had provided its development environment.

Organisation theory, meanwhile, was developing in parallel, and by the end of the 1960s there was not only a recognition of the need for project management as a discipline in its own right, but also the creation of the two major professional bodies for project managers, PMI (the Project Management Institute) in USA and IPMA (the International Project Management Association, formerly known as Internet) internationally, with its constituent national bodies such as APM (the Association for Project Management) in UK.

As organisation theory and project management met, the concepts of matrix organisations developed as applied to projects/functions, with some recognition that the nature of a project manager’s job would vary depending upon where along the spectrum from functional organisation through matrix to project organisation the enterprise chose to structure itself.

During the 1970s project management continued to spread throughout the traditional industries, with a specific impetus coming from the rise in the oil price from $3 per barrel to $12, with the consequent change in attractiveness of production from areas such as the North Sea, where the first discoveries in 1969 to 1971 were followed by an investment of over £60bn in oil and gas exploration and production facilities. This spawned the development of new methods of financing projects, with funds being raised for specific projects themselves rather than for the enterprise that is commissioning the project.

The 1980s saw a notable change in the political and economic environment on both sides of the Atlantic, and for the first time since the ancient world, a fundamental reconsideration of the roles of "owner" and "builder" through the introduction of BOO (T) contracts (Build, Own, Operate and Transfer) such as the Channel Tunnel and the Dartford Crossing.

The introduction of the IBM PC in 1982 also ensured that the role of IT in any business enterprise would be fundamentally transformed during the 1980s, and huge amounts of money were spent on managing international, national and enterprise-wide IT projects.

1.4.4 The era of "intellectual capitalism": project management since the mid-1980s.

The social and economic climate at the end of the second millennium is presenting enterprises with a fresh set of challenges, many of which are having an effect on the nature of projects that are undertaken, and on the project management practices that they employ.

- The development of global competition, for example, is resulting in major projects requiring the co-ordination of suppliers from different enterprises, based in different countries, with different languages and divergent cultures.
- The development of a global IT infrastructure is not only creating opportunities for many projects with a high IT content and with a business re-engineering focus, but is also changing the fundamental patterns of work within enterprises and within project teams.
- The growth of service industries is increasing the number of projects that produce "services" as products, as manufacturing productivity increases, and as the industrial needs of the first world are increasingly met by the growth economies of the developing world. Many writers on management and leadership trends (e.g.Belasco and Stayer, 1993) make the point that work, increasingly, involves the creation, transmission and manipulation of information and knowledge.
- The trend in the developed world to constraining government expenditure is leading to new approaches to infrastructure projects,

with increasing private sector involvement in initiatives such as PFI (Private Finance Initiative).

Enterprises are responding to the changed environment in many ways. A few of these ways that have significant implications for project management are worth mentioning.

- As stock markets develop more and more sophisticated electronic means of analysing, comparing and predicting corporate performance, enterprises are developing new and sophisticated methods of valuing themselves, and their component elements, adopting techniques such as EVA (Economic Value Added) or “balanced scorecards”.
- As specialised knowledge becomes more highly valued, organisations are increasingly turning to techniques such as “outsourcing” to obtain better value for non-essential activities, and different forms of strategic relationships with other enterprises that possess complementary capabilities to their own.
- The drive for survival and financial performance are combining to lead enterprises to continually seek fundamental performance improvements through such activities as business process re-engineering and competitive benchmarking.
- Within enterprises, as all these trends combine, the traditional relationships between managers and employees have been forced to respond. Increasingly enterprises are employing concepts such as “self-managing teams” and “empowerment” with the basic intention of getting higher productivity from each employee.

The effect of these changes on projects and project management has been far reaching.

- The improved business performance resulting from effective use of information technology is leading to an immense increase in the number of “business change” projects with their associated IT components.
- Radically new relationships between the “owner” the “operator” the “designer” and the “constructors” of a particular product such as a road, a hospital or an oil rig are leading to radically new forms of contract, and to radical new practices such as “alliancing” (where different parties to the agreement, for example the operator, the designer and the constructors commit themselves to a common

set of objectives, and operate as a single organisation, with gain-sharing and pain-sharing arrangements to safeguard the economic interests of each party) or “partnering” (where suppliers negotiate a strategic relationship that encompasses many projects, and that establishes the contractual rights, duties, service levels, and financial arrangements by which each project will be conducted).

- The overall availability of inexpensive software packages such as Microsoft Project and the ease of access to PCs or workstations, combined with the business trends to self-managed teams and to increased employee “empowerment” are changing the focus of project monitoring and control practices. The resulting “decentralisation” is leading to an increased need for large proportions of the project work-force to understand concepts such as risk management and change management, that lie at the heart of good practice for project control.
- The increasing intensity of global competition is raising the pressure for enterprises to reduce both costs and timescales for their projects.

1.5 Project management today - how industry thinks about projects.

A review of project management practices and techniques in more than 30 enterprises[5] in industries as diverse as pharmaceuticals, oil, construction, utilities, engineering, aerospace, rail transport, electronics, IT, financial services, telecommunications, retail and manufacturing shows up a number of characteristics of projects in the 1990s.

- Different industries each have their own way of thinking about projects, their own vocabulary for talking about projects, and their own versions of the disciplines of project management. Fora exist to promote cross-business dialogue[6], but managers in industry are still prone to complain that since each project is unique, and the drivers of performance in different industries are so different, there is relatively little that can be learned from each other.
- There is an increasing pre-occupation with the competencies that successful project managers need to possess. Ground-breaking work by Gadeken (1994) identified that the set of competencies possessed by outstanding project managers is different from that

possessed by outstanding line managers, and many leading enterprises are now seeking to confirm this for themselves and for their own kind of projects. Professional bodies such as PMI and APM are responding by offering a range of professional qualifications.

- Enterprises that need to respond quickly to external opportunities and that have large numbers of employees engaged on "project work" rather than "routine work" are turning themselves into "project-based organisations". The language of project management is thus being extended to include terms such as "project-based management" or "management by projects", while techniques for the effective control of the organisation's resources (such as programme management) are being developed.

- As the focus of enterprises on business processes continues to sharpen, there is a developing emphasis on the processes of project management. The 1996 re-issue of PMI's "Guide to the Body of Knowledge" (Duncan, 1996), for example, structures most of its text around the 37 processes that it sees as constituting the effective management of projects. Incidentally, only 8 of these are classified by PMI as relating to "project execution", with the remainder relating to various aspects of project management. Similarly, the release of the CCTA's PRINCE 2 project management methodology in 1996 is designed around the processes of project management. This increasing focus on processes is allowing the related concepts of identifying and describing "best practice" and of "benchmarking" to enter the arena of project management.

These factors combined to make the improvement of project performance a pressing need for industry and commerce in the closing years of the 20^{th} Century.

1.5.1 How project performance is measured in industry.

Projects represent an enormous investment by large sectors of industry, so improving project performance could have a major impact on competitiveness. Although there is general agreement within industry on the need to improve project performance, there is far from general agreement on how to measure, or even quantify, that improvement. The question of how project performance is measured is both important, and far from straightforward. Recent research such as O'Connor and

Reinsborough (1992) suggest that far from improving over time, the actual proportion of projects with a performance regarded as poor or worse is increasing.[7]

De Wit (1988) distinguishes between project success (measured against the overall objectives of the project) and project management success (measured against the widespread and traditional measures of performance against cost , time and quality). He points out that the different objectives that projects are designed to achieve can be arranged in a hierarchy, with not all equally important, and that the different stakeholders in the project such as owner, user, sub-contractor, supplier, or designer may all have success criteria that differ from each other. This makes the measurement of success a complex and inexact matter, since it is possible for a project to be a success for one party and a disaster for another. It can also appear to be a success one day and a failure the next.

The most widespread practice in industry today is to harmonise project and project management success by establishing quantified project objectives in terms of cost (the project budget), schedule (milestones and the project completion date) and product quality (usually defined in terms of project scope, but often including definitions of the performance of the facility, product or service produced by the project, and increasingly during the 1990s, the benefits that are to be harvested from the product.). Project performance is then measured in terms of actual out-turn compared with the planned out-turn in each of these key dimensions.

This is useful for an enterprise in terms of answering the question, “Did things turn out as we planned that they would?”, but it doesn’t answer questions such as, “Did we get value for money?”, “How well did we manage this project?”, or “How did our performance compare with that of our competitors?”.

At present, few organisations are truly in a position to obtain answers to these questions. The answers that are obtained are either restricted to a narrow set of metrics that can be obtained (such as time to market for a new motor car design) or are largely anecdotal.

To answer this kind of question more fully, three different kinds of metrics are needed (See Figure 3).

Business metrics — the financial and other parameters applied by the provider of funds for the project. Financial measures could include return on investment, while others might include entry into a new and attractive market. These measures will depend upon the strategic intent of the provider of funds.

Product metrics — the detailed benchmarks, by which the provider of funds can test whether or not they have been provided with the right product performing to the right standard for the right price and in a timely manner. Comparisons here are likely to be industry-specific such as the cost of designing and building a 500 MW generator, or the building of 5 miles of 8-lane motorway.

Best-practice metrics — relate to the practices and disciplines of managing projects, and examine the efficiency and effectiveness of the processes associated with managing the project from start to finish.

This research focuses on the third of these, "best practice metrics".

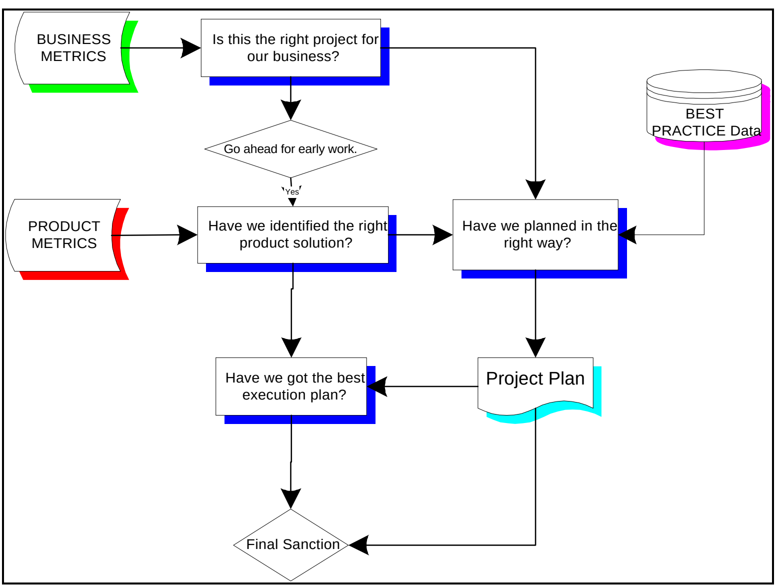

Figure 3: Different types of project metric

1.5.2 The need for improvement: why so many projects are seen to fail.

Projects in many industries continue to be plagued by poor performance (e.g. KPMG, 1997). Well publicised project difficulties such as the Channel Tunnel or the West Midlands Ambulance System, are matched by many less visible projects that are marked by "cost overruns, late deliveries, poor reliability, and users' dissatisfaction." (Abdel-Hamid and Madnick, 1991). Cost and schedule overruns, failure of the product to deliver the performance specified, failure to accomplish the beneficial change for which the product was intended, and aborting projects after significant expenditure are all part of everyday project experience for many enterprises.

In spite of the substantial effort invested in projects, enterprises are slow to learn lessons from specific projects and apply them to others. Why this should be so is a part of the "conceptual basis to project management" to which this research intends to contribute.

Certainly every project is by definition to some extent unique, and that makes every project a potential learning experience, but it also enhances the difficulty in applying lessons learned on one project to subsequent ones. This is why project based organisations have to learn how to learn, both from other organisations' experiences and from their own.

Most general textbooks on project management include an early section on "the causes of project failure". Kharbanda and Stallworthy (1983) attribute much of the cause of failure to the fact that decisions on project investment are taken by Boards of Directors on the basis of "mathematical wizardry" applied to numbers that have a very high degree of inherent uncertainty.

More generally, "shopping lists" of key reasons are cited, as in the two following.

> *Projects that have failed generally display several of the following characteristics:-*

> 1. *The customer's conditions of satisfaction have not been negotiated.*
> 2. *The project no longer has a high priority.*
> 3. *No one seems to be in charge.*

4. *The schedule is too optimistic.*
5. *The project plan is not used to manage the project.*
6. *Sufficient resources have not been committed.*
7. *Project status is not monitored against the plan.*
8. *No formal communications plan is in place.*
9. *The project has lost sight of its original goals*
10. *There is no change management process in place*

(Wysocki R. K., Beck R. Jnr., and Crane D. B., 1995, p. 57.)

Some common reasons for project management failure are as follows: -

1. *Lack of a project focal point.*
2. *Poor choice of organisational form of structure.*
3. *Project efforts in the hands of one of the lead functional groups.*
4. *Inadequate involvement of team members.*
5. *Inadequate planning.*
6. *Lack of top management support or project administration efforts.*
7. *Too little authority in the hands of the project manager.*
8. *Poor choice of project manager.*
9. *Team not prepared for team efforts.*
10. *Poor project communication.*
11. *Lack of team blending.*
12. *Unclear project mission.*
13. *Objectives are not agreed on; end result is unclear.*
14. *Inability to estimate target dates.*
15. *No hard milestones; little project control.*
16. *Poor planning of project installation and termination.*
17. *Poor technical and user documentation.*

(Kezsbom, Schilling, and Edward, 1989, p. 10).

The trouble with such shopping lists is that each Board of Directors, each Director of Projects and each Project Manager is free to pick for himself or herself the cause that they feel most comfortable eliminating. And when they feel that they have done that, there are plenty of others still left on the list! The task facing the profession of project management is to identify which causes lead to which effects, and thus to pave the way for a transition from “experience-based project management” to “evidence-based project management”.

1.6 Research questions that this thesis will attempt to answer

The cyclic nature of this programme of “continuous action research” will become clear in the course of this thesis. At an early stage in the process, after reviewing the discussion in this chapter, six fairly basic research questions were identified as follows: -

1) What aspects of project management are common to different industries?
2) Which aspects of project management (such as practices or processes) are sufficiently important to project-based organisations that they are felt to be worthy of measurement across industries?
3) What useful cross-industry “metrics” can be developed to measure the relative performance of these practices or processes, and what constitutes the “benchmark” for them?
4) What evidence is there from actual project outcomes that the “benchmark” practices translate into actual project performance?
5) In the light of project performance, which practices and/or processes can be demonstrated to have a determinative influence on project performance?
6) How can metrics that are relevant to determinative practices or processes be incorporated into useful predictive models?

1.7 Conclusion

Projects are a basic element of human endeavour. They have a long history extending back to times long before the terms “project” or “project management” were in common usage. Projects are integral to the way businesses work. One of the fundamental ideas on management is to break work up into “chunks” that can be managed, and projects are one important type of these “chunks”.

Projects are immersed in a social and economic environment, and a systemic context for studying projects will need to recognise the social context within which enterprises are initiated, the role that projects play in the enterprises and in modifying the social context itself, and finally the way that practices and techniques used in the management of projects are themselves conditioned by the social context.

Projects have gained in importance during the past two decades as competitive pressures in the business environment have necessitated the creation of products and services using increasingly complex technological solutions under increasingly tight time, cost and quality constraints. Performance is critical, and failure carries a high social and economic cost, so the current state of the art is in developing performance improvement techniques, tools and methods.

The stance taken by this research is to make the systemic context explicit, to seek a sound epistemic basis to the research, to adopt a point of view that formally involves a broad range of disciplines and industries, to utilise a pragmatic approach at all times, and to develop a methodology that both makes its conceptual basis explicit and also recognises the contributions that can be made by combining quantitative disciplines (such as benchmarking) with qualitative disciplines (such as process mapping and social-science research).

There is a big gap between the abstract concept of how to improve project performance and the reality of the existence of tools to do it, so the purpose of this research is above all practical. Answers to six questions will be sought through the research.

Chapter 2 will start the search by extracting from project management literature a summary of the prevailing worldview adopted by the Western world’s project management communities, and Chapter 3 will explore why it has been necessary to adopt a new research paradigm in order to create the tools necessary to measure improvements in project performance.

[1] Rodney Turner argues this point at some length in Op. Cit. Pages 5 and 6

[2] The assembly of fifteen organisations into a project management benchmarking network known as “Europe 1” was a part of the commercial activity that supported the research programme. The names of these and all subsequent organisations that became members are given in Appendix P-9.

[3] Exodus 18:13-26

[4] The framework for dividing capitalism into three eras - classic, managerial, and information - was developed by James Belasco and Ralph Stayer in some unpublished papers prior to their monograph, “The Flight of the Buffalo”.

[5] The original material for this research has been gathered from a network of major organizations. Chapter 4 describes the programme’s historical development. These general observations are drawn from the members of the network, and from other organisations that are known well to the author.

[6] For example PMI (The Project Management Institute) or IPMA (formerly known as Internet), the International Association of Project Management along with its national constituent bodies such APM in UK.

[7] Internal documents available to the author from a number of blue-chip private-sector enterprises substantiate this assertion.

Chapter 2:

2: The worldview of a project manager.

2.1 Summary

The previous Chapter described why it is a matter of practical interest and importance to large sections of industry to improve the practice of project management. The literature on project management is dominated to an overwhelming degree by practitioner-oriented writings – books and articles describing techniques that have been developed to help with specific aspects of managing projects in particular circumstances, or techniques that have been found to be generally helpful for project managers. The whole discipline could be described as “practitioner-led”.

A classical approach to the task of reviewing the literature would be to examine all the theoretical approaches that have been laid down with respect to project management. And this was done. The literature proved to contain a fragmented world of people quoting or assuming theories and applying them to project management with specific circumstances in mind (Cleland and King, 1983; Elmes and Wilemon, 1988; Abdel-Hamid and Madnick, 1991; Barnes, 1996) with no overarching approach to theory. A notable exception is the recent approach adopted at Erasmus University (Turner and Keegan, 1999; Turner and Keegan, 2000), although even this is characterising the whole field of project management as being concerned with control theory, thereby playing down the body of theory on organisation developmental and learning (Thomas and Tjåder, 2000).

The situation was further complicated by the speed of development of the corpus. A recent review of the research into project management during the past forty years (Kloppenborg and Opfer, 2000) found that 60% of the articles published on the subject have been published during the 1990s – which means that approximately a half of all the writing about project management has been written during the period of the research for this thesis.

In view of this, and since this research is essentially practical in its intentions, a different approach has been adopted. The chapter begins by referring briefly to three representative pieces of empirical research

– one each from the 1970s, 1980s and 1990s – in order to understand which practices are seen to correlate most closely to project management success.

A more global context for these empirical studies and the present research has then been established by searching the corpus of project management literature for what is distinctive about the way a project manager approaches his or her task – what, if you like, is the distinctive project management "worldview". To focus the search, a somewhat mechanistic analysis has been carried out that combines six representative "bodies of knowledge" about project management with a recently published analysis of the topics of journal articles about project management. This created a list of 60 terms that could be said to constitute the "core concepts" of the project manager's worldview.

A qualitative analysis of the definitions of these terms has then been carried out, to create a "narrative framework" of four themes divided into eleven topics, which is then described with illustrative citations from the literature. In the course of this narrative, comments about relevant theory have been interwoven with descriptions of practice, in order to paint as complete a picture as possible of the thinking that has led to the creation of the worldview.

The narrative framework is made explicit in a "systemigram" which hypothesizes how the eleven topics relate to each other, and how they combine to deliver the benefits of the project management worldview to society, industry and commerce.

Finally, the major elements of the existing worldview are compared with the practices found by the empirical research quoted at the start of the Chapter to lead most surely to project success, and questions are raised about the completeness and adequacy of current research into the worldview.

2.2 Which practices have been correlated to project success and project failure?

Many of the practitioner-focused textbooks on project management define project success in terms of the time, cost and product performance (expressed as quality, or scope, or conformance to requirements) compared to the plan, but as has been seen above, De Wit (1988) differentiates between the success of project management (for which these measures might be broadly appropriate) and the success of the project, which will depend on a wider range of measures. This distinction is important, although often ignored.

In this case, De Wit is following the classic work of Baker, Murphy and Fisher (1974), which is described below, and which was subsequently developed further by the same authors (1988). They conclude that “if the project meets the technical performance specifications and/or mission to be performed, and if there is a high level of satisfaction concerning the project outcome among key people in the parent organisation, key people in the client organisation, key people on the project team and key users or clientele of the project effort, the project is considered an overall success.” (ibid. p.903)

The importance of the distinction is emphasised by Munns and Bjeirmi (1996), who draw attention to the short-term goals of the project manager (in delivering the required product or service to schedule and within budget) as opposed to the long-term goals of the project (to deliver the promised business benefits). Kerzner makes a similar distinction between “successful projects” and “successfully managed projects”. “Successful implementation of project management does not guarantee that individual projects will be successful . . . Companies excellent in project management still have their share of project failures. Should a company find that 100 percent of their projects are successful, then that company is simply not taking enough business risks.” (Kerzner, 1998a, p. 37)

This discussion gives some indication of the complications inherent in assessing the extent to which improved project management practice can be shown to be of benefit to an organisation. Much of the literature has been derived directly or indirectly from Baker, Murphy and Fisher’s analysis of 650 projects (1974), as is shown in Crawford’s (2000) comprehensive review of the literature on project management success.

In order to establish a datum against which to compare the findings from this research programme, three studies based on empirical research have been described below: Baker, Murphy & Fisher’s (1988) considered findings from their analysis of 650 aeronautical, construction and other projects; Pinto and Slevin’s studies (1988a; 1988b) of answers provided by 418 project managers various industries , and Lechler’s survey (1998) of 448 projects in Germany. These three have been chosen as representative because of their empirical data from large samples of data, because they include projects from different industries, because they use complementary data analysis methods, and because they cover the past three decades, during which time 99% of all the articles published about project management have been written. (Kloppenborg and Opfer, 2000)

2.2.1 Baker, Murphy and Fisher

Baker, Murphy and Fisher adopted the definition of success that has already been cited above. It includes a number of factors, and the perceptions of success of different groups of stakeholders. Their conclusion is that there are 29 factors that strongly affect the perceived failure of projects, 24 factors that are necessary, but not sufficient, for perceived success, and 10 factors that are strongly linearly related to both perceived success and perceived failure (i.e. their presence tends to improve perceived success, while their absence contributes to perceived failure).

The output measure (whether the project was successful or not) was a simple categorization of projects into three success “bands”, based on a multiple of the factors contributing to their definition of success.

The ten factors are set out below.

1. Goal commitment of project team.
2. Accurate initial cost estimates.
3. Adequate project team capability.
4. Adequate funding to completion.
5. Adequate planning and control techniques.
6. Minimal start-up difficulties.
7. Task (vs. social) orientation.
8. Absence of bureaucracy.
9. On-site project manager.
10. Clearly established success criteria.

2.2.2 Pinto and Slevin

Pinto and Slevin derived from Baker, Murphy and Fisher an understanding of the factors that influence project success, and then developed from it a more explicit definition of the factors that contribute to success (See Figure 4). They then assessed the opinions of 418 PMI members who responded to a questionnaire about which factors were critical to which elements of project success (just over half of them were project managers, and nearly a third were members of project teams).

They also related the results to the particular phase of the project's life cycle within which each of the factors were significant., using a simple four-phase model: conceptualisation, planning, execution and termination. Participants were instructed to "think of a project in which they were involved that was currently under way or recently completed. This project was to be their frame of reference while completing the questionnaire. The four phase project life cycle . . . was included in the questionnaire, and was used to identify the current phase of each project." (Pinto and Slevin, 1988a, p. 70)

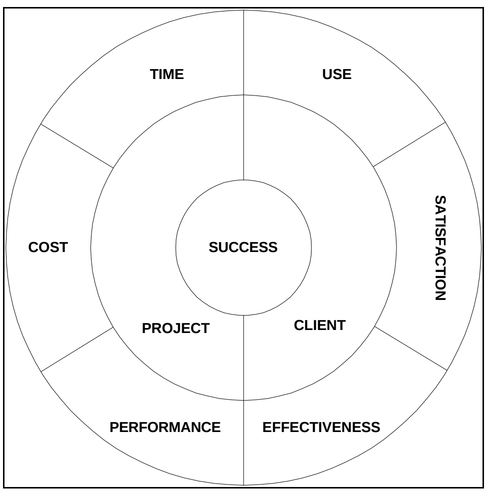

Figure 4: Pinto & Slevin's Model of Project Success. (Pinto and Slevin, 1988b, p. 69)

The results identified ten "critical success factors", which were then developed into an instrument to allow project managers to identify how successful they were being in managing their project. The ten factors are listed below.

1. Project mission – initial clarity of goals and general direction.
2. Top management support – willingness of top management to provide the necessary resources and authority/power for project success.
3. Project schedule/plans – a detailed specification of the individual action steps required for project implementation.
4. Client consultation – communication, consultation and active listening to all impacted parties.
5. Personnel – recruitment, selection and training of the necessary personnel for the project team.
6. Technical tasks – availability of the required technology and expertise to accomplish the specific technical action steps.
7. Client acceptance – the act of "selling" the final product to its ultimate intended users.
8. Monitoring and feedback – timely provision of comprehensive control information at each phase in the implementation process.
9. Communication – the provision of an appropriate network and necessary data to all key factors (sic) in the project implementation.
10. Trouble-shooting – ability to handle unexpected crises and deviations from plan.

2.2.3 Lechler

Lechler, in the most recent of the three empirical studies, also started from an analysis of the literature. His starting point was that "cause and effect" is rarely taken into consideration, but rather that the "critical success factors" are analysed as separate, independent variables. He reviewed 44 studies, covering a total of more than 5,700 projects and from them deduced that 11 discrete key success factors could be identified. Out of these, he chose the eight that were most frequently cited for his own empirical analysis.

Working from Pinto & Slevin's questionnaire, Lechler isolated 50 questions that corresponded to his chosen eight critical success factors, and distributed it to members of the German project Management Society (Gesellschaft für Projektmanagement – GPM). Each respondent was sent two questionnaires and asked to complete one for a project that they considered to be successful, and one for a project that they considered to be unsuccessful. They were invited to assess the project as successful if "all people involved" regarded the process (social success), the quality of the solution (effectiveness) and the adherence to time and cost objectives (efficiency) as overall positive.

A total of 448 questionnaires were received and analysed, 257 of them relating to "successful" projects, and 191 to "unsuccessful" ones.

The first step in Lechler's analysis was to seek correlations between individual technical factors included in the questionnaire and overall project success. Only four factors were found to have significant correlations:

- The appropriate technology (equipment, training programmes etc.) has been selected for the project.
- Communication channels were defined before the start of the project.
- All proceeding methods and tools were used to support the project well.
- Project leader had the necessary authority (a composite of four different questions)

The second step in the analysis was to carry out a LISREL analysis (Linear Structural Relationships) for the eight critical success factors. This resulted in the path diagram shown in Figure 5.

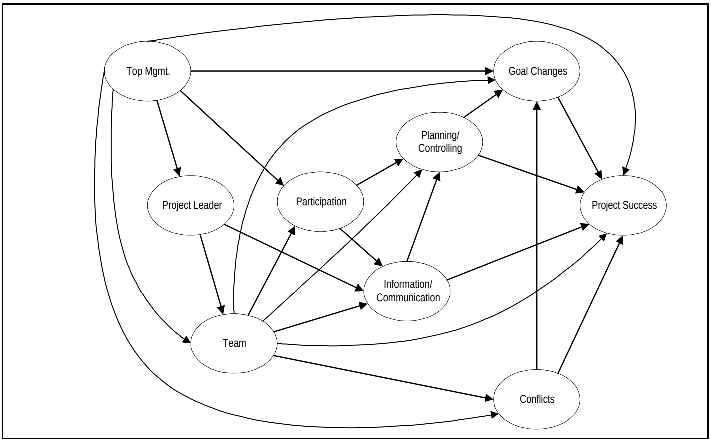

Figure 5: Lechler's Causal Analysis

Weightings were calculated for the various different paths of "causality" which, cumulatively, gave a value for r^2 of 0.59: 0.47 from the "people" factors (top management, project leader and project team), and only an incremental 0.12 from the "activities" (participation, planning and control & information and communication) and "barriers" (conflicts and changes of goals). Lechler indicates the importance that he attaches to this conclusion through his choice of title for the paper – "When it comes to project management, it's the people that matter."

The weighting given to each of the eight factors was a follows:

Factor	**Direct**	**Indirect**	**Total**
Top Management	0.19	0.41	0.60
Project Leader	-	0.18	0.18
Project Team	0.16	0.36	0.52
Participation	-	0.10	0.10
Planning/controlling	0.16	0.01	0.17
Information/communication	0.12	0.06	0.18
Conflicts	-0.21	-0.08	-0.29
Goal changes	-0.20	-	-0.20

2.2.4 The implications of "critical success factors"

The implication from these three pieces of research (and others that follow a broadly similar line) is that some aspects of project management are more important than others. They purport to give the practitioner some guidance in terms of what aspects of project management to concentrate on. Later in this chapter, the conclusions will be reviewed for completeness against the broad backdrop of a project manager's worldview. But before that can be done, it is necessary to make that worldview explicit, and to express it coherently.

2.3 What a worldview is and how it can be made visible

Project management is not often thought about or referred to as a "worldview". It is much more frequently referred to in terms of techniques and practices – "a core competency, widely recognized across a wide range of industry sectors" (Morris, 2000) – or even, increasingly, as a profession e.g. (Turner, 2000b). This development is itself an interesting phenomenon that begs the question, "What is it about project management that leads its practitioners to regard themselves as members of a unique profession?”

Whatever it is that distinguishes project management, it involves a way of thinking about work in project terms and a way of putting that thinking into action. It employs a set of categories and makes a number of distinctions[1] that facilitate the management of projects and project teams. Project management can be thought of, in other words, as a worldview.

“Worldviews have to do with the presuppositional, pre-cognitive stage of a culture or society. Wherever we find the ultimate concerns of human beings, we find worldviews. . . ‘Worldview’, in fact, embraces all deep-level human perceptions of reality.” (Wright, 1997: 122-123)

Distinguishing and describing a worldview isn’t easy. By its very nature it is invisible, embedded in the fabric of society and practice. To achieve the goal of making it visible will necessitate distinguishing figure from ground until, as in some etching by Escher, the project management worldview can be made to stand out from the environment that surrounds it. Possibly the most breathtaking example of using a study of worldviews to perform serious historical research in an area strewn liberally with the burnt-out hulks of scholars who have self destructed has been carried out by Tom Wright in the first two sections of a projected 5 part work examining the origins of the Christian religion. (Wright, 1997; Wright, 1999)

For the purposes of this study, the full rigour of Wright’s method is scarcely appropriate, but if significant improvements are to be made to project management practice, it is necessary to find some way of describing the project management worldview, and seeking areas in which it might be incomplete or unhelpful. Wright distinguishes four elements to any worldview – stories, questions and answers, symbols and praxis. This chapter will focus on only one of them.

As projects have increased in importance to organisations, thinking about project management has developed proportionately and an extensive corpus of literature has grown up, most of it designed for or written by project management practitioners. It is in this corpus that the search can begin for the “praxis” of project management – the most readily accessible aspect of the worldview.

2.4 The project management "worldview".

2.4.1 "Praxis" – What a project manager does.

There are many ways to approach the topic of project management "praxis", and the development of "praxis" has been what this whole programme of research is about. Chapter 4 describes the cycles of action research that have contributed to the understanding expressed in this dissertation, but the point should be made that the "worldview" described in this chapter is the latest of a number of iterations that have been emerging over a period of six years.

Indeed, the work in this chapter, culminating in the creation of a "cause and effect" diagram (Figure 6) explaining how the elements of a project manager's worldview inter-relate is, in itself, a piece of original research that combines a review of the literature, expert validation of conclusions extracted from this, qualitative research to construct a narrative worldview, and system dynamics thinking to generate the "systemigram".

In terms of the literature, however, a sensible place to start is to examine the practices that are seen by the professional bodies as constitutive of project management in the "bodies of knowledge" (BOKs).

There are a number of these BOKs including those supported by PMI (which is more correctly referred to as a "guide" to the body of knowledge, rather than confusing the information contained in a publication with the "knowledge" itself (Duncan, 1996), by APM (APM, 1995), by IPMA (Caupin et al., 1999), by the Centre for Management by Projects at UMIST on behalf of the APM (Morris, 2000), and by the International Journal of Project Management (Turner, 2000a; Turner, 2000b). The organisations taking part in this research programme have themselves developed what could be regarded as a list of topics that should be included in any guide to the "body of knowledge" about project management.

Each of these six BOKs is presented in terms of its own classification structure, in some cases with major differences. The focus at this early stage of the discussion, however, is better trained on the "content" of the knowledge, rather than how it is structured. Appendix P-1, Table 1 lists the topic areas that are used to describe categories in each of these six BOKs, with each list arranged in alphabetical order and stripped of all explicit structure.

Approaching the topic from a different angle, Max Wideman (1999) has published on the Internet a comprehensive glossary of terms used in association with project management, and in an unpublished paper, has further crystallised these down into a list of more than 3000 "single term" concepts (Wideman, 2000). His list forms an excellent basis for crystallising out from the alternative BOKs those terms, and therefore the concepts behind them, that underpin the "worldview" of a project manager.

Taking each of the terms listed in Table 1 of the Appendix P-1, the most appropriate term or terms from Wideman's glossary were identified that described the terms as used in the BOK. This gave a single list of 202 terms, as shown in Table 2 in the same appendix.

This list doesn't contain terms describing all the concepts that shape a project manager's "praxis", but it does contain all those terms that are used by one or more BOKs to provide a heading for knowledge areas that are important to a project manager. It could be said to be the most important high-level concepts that a "professional" project manager could be expected to know about. Sadly, it is still fairly extensive, and some more winnowing is in order.

2.4.2 Salient elements of the "praxis"

A further insight into the "praxis" that most concerns project managers can be obtained from examining the contents of the "professional" journals that project managers contribute to. In the English language, there are primarily two of these – the International Journal of Project Management (published in Europe) and the Project Management Journal (published in USA).

A recent article in IJPM (Themistocleous and Wearne, 2000) identified the topics that had been most extensively written about in IJPM from 1984 to 1998, and examined how the balance had changed during the time. The same article compared the balance of topics between IJPM and PMJ for a ten year period from 1990 to 1998. Appendix P-1, Table 3 contains a summary of the data from this article, while Appendix L-1 contains somewhat more detail.

This data can also be correlated to Wideman's single term glossary, so that it is possible to create a single "high level" list of the concepts that are of most interest to the professional project manager by selecting from the list of terms in Appendix 2 Table 2 those terms that occur in two or more BOKs, and that are implicit in the 44 topics identified by Themistocleous and Wearne. (2000)

That gives the list of 60 terms contained in Table 2. The numbers refer to the alphabetic position of the term in Appendix P-1, Table 2.

No.	Single Term Glossary	% 84-98	BOKs
12	Business case	0%	1
15	Change		2
16	Change control	3%	3
18	Close-out		3
21	Communication		4
26	Configuration management	3%	3
27	Conflict management	1%	3
29	Contract administration	9%	2
33	Cost	5%	1
35	Cost control		2
39	Culture		2
42	Design	2%	2
47	Estimating		2
50	Finance		3
51	Financial management	4%	1
53	Hand-over		2
56	Industrial relations	0%	1
59	Information management	18%	1
64	Integration	1%	3
67	Leadership	3%	3
71	Legal awareness	1%	1
74	Management by projects		2
78	Managing change		2
79	Marketing	1%	3
85	Negotiation		3
91	Organisation structure		2
92	Organisational design		2
93	Organisational learning		2

96	Performance measurement	4%	1
97	Performance measurement techniques		2
98	Performance reporting	7%	1
100	Personnel management	7%	1
106	Post-project evaluation review	1%	1
111	Procurement	1%	5
114	Program management	2%	4
116	Project appraisal	4%	2
117	Project close-out	0%	2
118	Project context	5%	2
124	Project life cycle	2%	3
125	Project management	28%	4
127	Project management plan	9%	1
130	Project organisation	10%	2
136	Project startup	2%	2
137	Project strategy		3
139	Project success/failure criteria		2
142	Quality		3
145	Quality management	4%	1
151	Requirements management	2%	1
152	Resource management	4%	2
153	Resource planning		2
158	Risk management	12%	3
162	Safety	1%	3
163	Sales	1%	2
164	Schedule control	10%	1
181	Strategy	5%	1
182	Success, project	3%	2
186	Systems management	4%	2
190	Teamwork	4%	2
192	Testing	0%	1
199	Value management		3

Table 2: Salient Concepts in a project manager's worldview.

Definitions for each of these terms from Wideman's glossary (1999) are provided in Appendix 5. A careful analysis of these definitions using Nvivo software shows that the sixty core terms can be related to the elements of the total project management system as follows (see Figure 2 in Chapter 1, and Figure 21 in Chapter 4).

	Technical Topics	**People Topics**
Concerned with the Project itself, or the product it is producing.	Change control (1) Close-out Configuration management Contract administration Cost Cost control Design Estimating Hand-over Information management Integration (1) Performance Measurement Performance Measurement Techniques ("PMT") Performance Reporting Project Appraisal Project Close-Out Project Life Cycle Project Management Project Management Plan Project Start-up Project Strategy Project Success/Failure Criteria Quality Quality Management Requirements Management Resource Management Resource Planning Risk Management Safety Schedule Control Success, project Systems Management Testing Value management	Conflict Management Integration (1) Leadership Project Organisation Teamwork
Concerned with both the Enterprise and the Project.	Business Case Change Control (2) Communication	Communication Culture Integration (2)

	Finance Financial Management Legal Awareness Organisational Design Procurement Program Management Strategy	Managing Change Negotiation Organisation Structure Organisational Learning Post-Project Evaluation Review
Concerned with the Enterprise undertaking the Project	Management by Projects Marketing Sales	Industrial Relations Personnel Management

Table 3: A project manager's focus, defined by the elements of the system.

2.4.3 Validation of the core "praxis" elements

The technique described above to narrow down the field of project management "praxis" to manageable proportions was very mechanistic. It has resulted in a certain amount of near duplication (e.g. "change" and "managing change", "performance measurement" and "performance measurement techniques"). Nevertheless, it has found substantial confirmation in practice. In a topic such as project management, which is so heavily practitioner-led, tacit knowledge plays a significant role. Under these circumstances, the opinions of people who are widely respected in the profession, and who have acquired substantial personal experience in the field, is an important source of such tacit knowledge. (Skyrme, 1997)

At a workshop in Haugesund, Norway in June 2000[2], organised by Lynn Crawford, and sponsored by Telenor, a group of thirty acknowledged international "thought leaders" from the world of project management were asked to use the basic sixty terms to propose alternative structures for the project management "body of knowledge" from alternative perspectives. Groups worked on this from the point of view of project sponsors, Chief Executives of commercial organisations, project managers, project management educators and disseminators, and managers of portfolios of projects.

None of these groups found that the sixty elements were unsuitable for the task – there were neither significant omissions, nor unsupportable elements that did not belong. Minor omissions, and the removal of duplication were all that was necessary to use the terms as a minimalist pointer to the extent of the knowledge necessary to support project management.

This method of validation is entirely consistent with the methodology employed throughout the action research programme that is described in this thesis – making use of the tacit knowledge of a “community of practice” to validate hypotheses, prior to taking action that could indicate the validity of the hypothesis. On its own, it proves nothing, but taken with the other indications, it provides “triangulation” or “complementarity” for the field of research. (Flood and Romm, 1997)

It should be pointed out also, that the glossary of terms, which was used as the basis for the mechanistic part of the praxis, was itself augmented by terms produced in a workshop in Norfolk, Virginia in June 1999[3], also organised by Lynn Crawford and sponsored by NASA, which was the forerunner of the Haugesund event.

2.4.4 A review of the “praxis” elements

Once the mechanistic part of the review was completed, a qualitative analysis followed. The definitions were imported into a qualitative analysis software programme (Nvivo), and the text in the definitions was encoded according to the three kinds of topics identified in the most recent version of the Corporate Practice Questionnaire used in the action research part of this research (See Chapter 4 and Appendix P-5). Table 3, containing this initial analysis, shows that project managers are overwhelmingly concerned with techniques to assist with the management of their particular project and to a lesser extent with linking their project into the enterprise that is sponsoring it. The reasons for this are not hard to find.

Projects are different from operations, as was made clear in Chapter 1, and the overwhelming focus of management attention and management theory has been on the management of ongoing operations. It is hardly surprising, therefore, that project management praxis has concentrated on those practices that are useful for managing a project and that are different from those generally encountered in the management of ongoing operations.

The second part of this qualitative analysis consisted of seeking to identify specific themes and topics that could be regarded as forming a possible “framework” for a “narrative” account of the worldview. This called for a much greater exercise of personal judgement and intuition, and was accomplished in three iterations. Firstly, each definition was carefully read through, the underlying topics were identified, and the coding was accomplished. Each term could be coded to any number of different topics.

The second iteration consisted of writing a first draft narrative, drawing on the definitions of the core terms, on the points made about the topics in the literature, and on relevant theory. Finally, elements of unnecessary duplication were removed, through making a serious attempt to locate each core term in the specific theme or topic to which it most readily applies, allowing duplicates only where the theme or topic are seriously depleted by the omission of the term.

Summary of themes, topics and terms

The following list summarises the elements of the worldview, as they will be discussed in the narrative framework. In total there are five themes and eleven topics.

Theme 1: Practices relating to the nature of the particular project

Topic 1: Establishing a strategic framework for the project.

Topic 2: Establishing, specifying and achieving the project's goals.

Topic 3: Defining, specifying, assuring, manufacturing and delivering the product or service.

Topic 4: Identifying, structuring, planning, executing and controlling the work to be carried out.

Topic 5: Managing the uncertainty that is inherent in the uniqueness of the project.

Theme 2 (Topic 6): Practices relating to the stages the project will need to pass through

Theme 3: Practices relating to "beneficial change" that the project is intended to accomplish

Topic 7: Projects as a means of implementing business strategy

Topic 8: Defining, quantifying and harvesting organisational benefits as a result of carrying out the project.

Topic 9: Allocating organisational resources to the project

Theme 4: Practices relating to the people that are associated with the enterprise

Topic 10: Identifying and aligning the interests of the project "stakeholders".

Topic 11: Creating, leading and managing the temporary team who will carry out the project.

For the sake of clarity, each of the sixty key terms is underlined in the text that follows the first time that it appears in each of the eleven topics. Extensive use is made of the actual definitions of terms, and these are attributed to their source according to the list of definitions published in Appendix P-1, Table 5

Theme 1: Practices relating to the nature of the particular project

In Chapter 1, the definition of work that could reasonably regarded as a project was "a unique scope of work that is constrained by cost and time, the purpose of which is to create or modify a product or service so as to achieve beneficial change defined by quantitative and qualitative objectives." Apart from the catch-all group of practices defined simply as "project management" (which was discussed fully in Chapter 1), there seem to be five prominent groups of practices that make up practices for dealing with a particular project, each of which makes sense in terms of the above definition.

- Practices to assist with identifying and taking the necessary strategic decisions about how the project is to be governed, planned and controlled.
- Practices to assist with the formulation, definition, refinement, acceptance and achievement of the project's goals – "qualitative and quantitative objectives".
- Practices to assist with the requirements, design, manufacture, quality assurance and delivery of the product or service that the project is intended to create or modify – "create or modify a product or service".
- Practices to assist with defining, structuring, planning, controlling and executing the work to be done to accomplish the project's

goals and to deliver the required product or service "a unique scope of work".

- Practices to assist with the management of the inherent uncertainty associated with the unique nature of the project and its environment – "constrained by cost and time".

Topic 1: Establishing a strategic framework for the project.

The three topics that project managers think about when considering the strategic issues raised by the specific nature of the project are design, project strategy and information management.

Design is "the process of developing and documenting a solution to a problem using technology experts and tools."(Wideman, 1999). As such it influences not only the product or service that is to be delivered, but also how the product or service is best to be specified, designed, manufactured and implemented.

This calls for a project strategy. "Projects should have a high level comprehensive definition of the way they are to be developed and managed. All major issues should be addressed i.e. technical, financial, organisational, time and quality as well as safety, human resources, logistics, procurement, information systems and technology." (Wideman, 1999) Thus, presumably, the project strategy document is intended to cover both project governance and operational planning and control. The strategy will usually be developed as a part of the initial project plan development, and will ultimately be reflected in the project management plan (see Topic 2, below).

Implied in the project strategy will be the need for information management – "the management of the systems, activities, and data that allow information in a project to be effectively acquired, stored, processed, accessed, communicated, and archived. There should be a valid audit trail of this communication process. Projects generate and absorb significant quantities of information. It is important that the project has an effective information management system. Tools and techniques for monitoring progress." (Morris, 1999). This definition, the most comprehensive of those provided by Wideman, is in itself revealing. It can be argued that the primary purpose of information is to provide control, rather than simply to provide communication to interested parties. As will be seen later in this Chapter (for example in

Figure 7) and more significantly in Chapter 5, the explicit consideration of precisely how projects are controlled (in the technical sense of how people in authority respond when reality diverges from plans) is one area that is incompletely understood.

Topic 2: Establishing, specifying and achieving the project's goals.
The central concept that drives the definition of project goals is establishing project success/failure criteria. These are "the criteria by which the success or failure of a project may be assessed." (Wideman, 1999). More specifically, they are "criteria that should be clearly defined and agreed before significant development is initiated. These may be defined in a number of ways such as: business objectives (or goals); requirements, typically technical (performance) requirements ; critical success factors, typically measurable factors that, when present in the project's environment, are most conducive to the achievement of a successful project; key performance indicators, typically measures upon which the project will be judged. Success Criteria and the manner of their achievement should be documented in the project's strategy plan." (Morris, 1999)

What constitutes success or failure has already been discussed in Section 2.2.

Once the criteria for success have been defined, they are embodied in a project management plan, which is "a baseline tool used as a reference for managing the project. It is the most important document in the overall planning, monitoring, and implementation of a project and it should be 'owned' by the project manager and his or her team. The plan should include: a definition of overall objectives, statements on how these should be achieved (and verified); estimates of the time required; the budget; quality policy; safety, health and environmental policies, and the risk management strategy." (Morris, 1999)

Other items of a technical, commercial, organisational, personnel or control nature might also be included.

"The Project Management Plan establishes project management's interpretation of the why, what, how, who, how much, and when of the project." (Morris, 1999)

People are involved in the creation of the project management plan during "the complex sequence of activities that are required to start the project, mobilize the team, initiate the project definition process, obtain agreement to the project's objectives and plan to deliver them." (Wideman, 1999) These activities are known collectively as <u>project start-up</u>.

Two of the "softer" or people-oriented sets of concepts become important during and after project start-up: <u>leadership</u> and <u>conflict management</u>.

Leadership is important because "the project manager typically works through a project team consisting of individuals with diverse backgrounds, education, experiences and interests. One secret to successful project implementation is the project manager's ability to get this diverse group of actors performing at maximal effectiveness. Consequently the project manager must be both a leader and a motivator of the members of the project team. He or she is often required to work through others while possessing minimal legitimate line authority over their actions. Consequently, the techniques of effective leadership and motivation become very important in the project management context." (Slevin and Pinto, 1988, p. 739).

Conflict management matters because "conflicts are very likely to occur in the temporary project environment where the project manager is often the new player who has not had time to develop good working relationships with project team members or with supporting functional managers. The conflict potential is also increased by the great differences between the project and functional goals and objectives, and by the unavoidable competition between projects for resources."(Stuckenbruck, 1988, p. 73). An interesting case study describing the effects of conflict, also shows the benefits of designing a research intervention that employs multiple methodologies. (Bennet et al., 1997)

Throughout the process, a key project management function that influences not only the goals of the project, but all aspects of its management is <u>integration</u> – "the process of bringing people, activities and other things together to perform effectively." (Wideman, 1999) It is this aspect that is most emphasized by Gaddis (1959) in his classic article.

Three specific aspects of planning are relevant to making the goals tangible and measurable: <u>cost</u> planning and <u>cost control</u>, <u>resource</u>

planning and control and schedule planning and control. Taken together, these three elements express the project's goals in terms of three types of measurable quantities that can be controlled during the execution of the project.

"Cost can be divided into internal and external expenses. External costs can be controlled by contracts and budgets for each phase of a project and for each deliverable or work product. Internal cost is the cost of project resources." (Wideman, 1999) Resource planning involves "evaluating what resources are needed to complete a project and determining the quantity needed." (Wideman, 1999) And schedule planning and control can be viewed as "project time management [a more technically precise name for schedule planning and control, and which] includes the processes required to ensure timely completion of the project." (Duncan, 1996) All of these depend on the practices and disciplines of defining and managing the product to be delivered, and the work to be done, which are two topics that are dealt with in separate sections below.

Schedule control has become a topic of interest and controversy within the project management occupation, with the application of "theory of constraints" to project management. (Goldratt, 1997)

Increasingly during the 1990s project managers have taken the opportunity during the course of the project to evaluate and re-evaluate whether the project is being conducted in the most effective way, using value management. Value management is "a structured means of improving effectiveness in line with the organisation's goals. It refers to the overall process of identifying key issues and setting targets; identifying the teams and processes necessary to achieve these; and implementing these to obtain successful results. It is concerned with the broader optimisation of strategic issues, encompasses the value engineering process at the project's strategic definition stage and is generally done via a structured workshop." (Morris, 1999)

During the course of a project, the means used to monitor the accomplishment of project goals are generically known as performance measurement. The APM Body of Knowledge (APM, 1995) describes performance measurement as "the concept used to represent physical progress achieved in relation to cost and schedule performance by means of introducing the calculation of Earned Value." The term

"Earned Value[4]" was developed in 1963, and first introduced a year later as a part of the U.S. DoD's Minuteman Contractor Performance Measurement System. (Morris, 1994)

Earned Value Analysis has now become the most widely practiced among performance measurement techniques. The technique of "Earned Value Analysis" is a component of the C/SPEC methodology (Fleming, 1992), and it is now firmly entrenched in practice as a means of measuring the progress of both cost and schedule against original estimates. BS6079 (1996) asserts that "a key principle of good project management practice is the use of performance measurement techniques such as earned value analysis at the task level", and even where doubts are expressed as to the strength of both the underlying assumptions and the underlying mathematical model (Maylor, 1996) the usefulness of the technique to the "beleaguered project manager" is acknowledged (albeit somewhat with tongue in cheek). A study carried out on behalf of the DoD by Arthur D. Little in 1983 concluded that C/SCSC contributed more benefits than it cost, but suggested some improvements that were desirable. (Fleming, 1992)

There are two aspects to monitoring the accomplishment of project goals. During the course of the project, performance reporting is used, and after completion of the project post-project evaluation review. "An important review of project performance and lessons that can be derived from the project conducted once operations have started. Although often considered only after completion of the project, in practice Project Evaluation can and should be a fully integral part of the project. Similar reviews should therefore also be carried out periodically during the course of the project, with the resultant information/lessons fed back into this and other projects." (Morris, 1999) A recent qualitative analysis of four such appraisals has identified both the difficulties and the benefits from conducting such reviews. (Busby, 1999) Unfortunately, although virtually every body of knowledge professes the importance of these reviews, they are rarely written about in any journals (Themistocleous and Wearne, 2000), because of the pressure on project managers to get on with their next project. (Cooke-Davies, 2000b)

Topic 3: Defining, specifying, assuring, manufacturing and delivering the product or service.

The first step in defining the product or service that the project will produce is known to project managers by the term <u>requirements management</u>, defined as "the process of defining the user/customer requirements and building the system requirements before going on to develop the performance specifications in detail. Requirements should be comprehensive and clear, well structured, traceable and testable. They should give rise to clearly specified project deliverables and should be tested against the original set of requirements. Any changes to the initial requirements should be traceable i.e. documented and explainable." (Morris, 1999)

Two constraints that will generally bound the freedom to fulfil the requirements are the availability of money, which calls for <u>financial management</u>, and the legal and commercial context within which the product or service is being delivered. This latter requires <u>legal awareness</u>.

Financial management can be thought of as "management of the financial activities of the organisation, program, project or major work package."(Wideman, 1999) More recently, it has been observed that "financing the project is normally the sponsor's responsibility. The project management team should know, and be sensitive to, the impact of how the project is financed and the particular requirements imposed on the project by its financing. . . .Some understanding of the relationship between management accounting and project accounting/cost control is generally necessary." (Dixon, 2000)

Legal awareness is "an awareness of the relevant legal duties, rights, and processes which govern in a particular project situation. It may cover potential causes of disputes, liabilities, breaches of contract, means of resolving a dispute, and legal basics of industrial relations." (Morris, 1999)

The details of how the product or service is to be manufactured or otherwise provided are detailed in the <u>project management plan</u>, which was described above. Two particular sets of practices have been developed and refined to assist with the manufacturing of the product or service – <u>systems management</u> and <u>procurement</u>.

Systems management can be thought of as “the elaboration of the specification for the technical, organisational, cost, time and other parameters of a system and the subsequent management of the planning, design, engineering, procurement, implementation and testing areas of the work needed to realize the system concept. Systems management comprises the prime activities of systems analysis, systems design and engineering and systems development. Editor's Note: 'development' in this context means the implementation of the design and engineering”. (Project Manager Today, 1997) quoted in (Wideman, 1999)

Procurement, on the other hand, while always used to some extent on every project, is particularly relevant when a project strategy has been adopted that requires major parts of the product the be acquired from external suppliers. Procurement is “the process of acquiring new services or products. It covers the financial appraisal of the options available, development of the procurement or acquisition strategy, preparation of contract documentation, selection and acquisition of suppliers, pricing, purchasing, and administration of contracts. It may also extend to storage, logistics, inspection, expediting, transportation, and handling of materials and supplies. It may cover all members of the supply chain. For example, operations and maintenance needs to be supported through a supply chain management process.” (Morris, 1999)

Clearly, the activities involved in the practice of integration (described above) play a major part in producing the product or service, as do three other topics that make up a part of the project manager’s worldview – quality, quality management and value management.

A widely accepted definition of quality is “the totality of features and characteristics of a product or service that bear on its ability to satisfy stated or implied needs.” (ISO 8402 quoted in (Ireland, 1991)) while quality management comprises “all the activities of the overall management function that determine the quality policy, objectives and responsibilities, and that implement them by means such as quality planning, quality control, quality assurance and quality improvement within the quality management system.” (Caupin et al., 1999)

Value management has been discussed above, but it clearly assists the project team to refine the product or service that is being produced.

As the product nears completion, the project manager is advised to pay attention to testing, to hand-over and to project close-out.

Testing is "that element of inspection that determines the properties or elements, including functional operation of supplies or their components, by the application of established scientific principles and procedures." (US Federal Acquisition Regulations, quoted in (Ireland, 1991).)

Hand-over is "a process of transfer of responsibility for all or part of a project or its deliverables. Typically, this takes place at the end of a project or a major part thereof." (Wideman, 1999) It is closely related to the idea of project close-out – "a process that provides for acceptance of the project by the project sponsor, completion of various project records, final revision and issue of documentation to reflect the "as-built" condition and the retention of essential project documentation." (Duncan, 1996)

Topic 4: Identifying, structuring, planning, executing and controlling the work to be carried out.

If a new or modified product or service is to be specified, designed, constructed, tested and delivered, then one of the central tasks of project management is to identify what work needs to be done and who is to do it, and then to oversee the work so that it is done as well as possible. "A fundamental aspect of effective project planning, and therefore of effective project management, is the process of defining the scope of the project and of breaking this into manageable pieces of work." (Dixon, 2000)

Techniques for doing this have been at the heart of the practitioner focus on project management, at least since the time of Henry Gantt, originator of the eponymous Gantt chart. A whole series of practices embracing integration, estimating, schedule control, resource planning and management, procurement, and requirements management contribute to the effective definition of the work to be done.

In some industries, safety (more generally referred to under the generic heading of HSE – Health, Safety and the Environment) assumes a significant role in dictating not only what work is to be carried out, but how it is to be executed. Similarly, if a "procurement"-based project strategy has been adopted, then it is important to allow for contract administration, the "monitoring and control of performance, reviewing progress, making payments, recommending modifications and approving contractor's actions to ensure compliance with contractual terms during contract execution.” (Wideman, 1987)

Two further concepts that are important to the management of projects and less so to the management of operations are change control, and the related techniques of configuration management. Change management, as it is generally defined, has two different aspects to it. The one relating to the work to be done on a project is “the process of accepting or rejecting changes to the project's baselines. Lack of change control is one of the most common causes of scope creep.” (Wideman, 1999) “Configuration management is the process of ensuring that the project delivers everything it is supposed to – physical products and assets, quality products, documentation, deliverables etc. – such that there is complete assurance on delivery integrity. It is particularly concerned with managing the status of pending and approved changes to the project deliverables and with managing the information that define the configuration status.” (Dixon, 2000)

Since work is generally accomplished by a group of people, two of the “softer” concepts that constitute the project manager’s worldview are relevant to the topic of the work to be done – teamwork and conflict management. “Effective teamwork is generally at the heart of effective project management. The project management professional should be familiar with the process of forming a group of people into a project team that is to work together for the benefit of the project. This can be achieved in a formal manner by use of start-up meetings, seminars, workshops, etc. and in an informal manner by getting the team to work well together. Motivating and resolving conflicts between individual members of the team are important elements of teamwork. Cultural characteristics of the team members should be given full consideration: different cultures create different working needs.” (Dixon, 2000)

Topic 5: Managing the uncertainty that is inherent in the uniqueness of the project.

A central construct of the project manager’s worldview is the need to manage the risk inherent in the project. A risk is an event that may or may not happen, and that, if it does, will have adverse consequences for the project. Project risk management is a relatively new field, but it is one that has received a great deal of attention in recent years.. “All projects, in common with all future work, are risky. A sponsor cannot be absolutely certain that the anticipated benefits from the project will be fully realized however successfully the project has been carried out . . . Unless risks are recognized they cannot be dealt with. If the risk identification process is to be effective, risk should be seen as arising from any significant threat or area of uncertainty that the sponsor and project manager may face during the life of a project." (BSi, 1996) A recent study of forty years of project management research has identified that 10% of the research papers that have been published on project management during that period have been on the subject of risk management. (Kloppenborg and Opfer, 2000).

The second construct generally associated with change control is also related to the reduction of risk and the removal of uncertainty from the project. In this sense it is defined as "the process of implementing procedures which ensure that proposed changes are properly assessed and, if approved, incorporated into the project plan. Uncontrolled changes are one of the most common causes of delay and failure." (Project Manager Today, 1997)

One of the more recent topics to find its way into the core worldview is that of organisational learning, defined as "the ability of the organisation as a whole to capture knowledge and experience from past projects and apply that to future projects. A relatively new management concept designed to improve the overall performance and responsiveness of an enterprise and avoid the loss of this information when individual personnel leave the enterprise's employment." (Wideman, 1999) It is a subject that bears significantly on an organisation's ability to manage the uncertainty that is inherent in the project.

Every project is to some extent unique. That makes every project a potential learning experience, but it makes it difficult to apply lessons learned on one project to subsequent ones. For this reason, the subject of organisational learning is central to an understanding of project management, even though it is rarely mentioned in project management literature. Even when it is it's character is essentially static and "one-off", rather like a post-project review. Kharbanda and Stallworthy (1983), for example, analyse sixteen major projects that went seriously wrong, and concluded by learning the same lessons that they had already embodied in earlier work (Kharbanda O.P., Stallworthy, and Williams, 1980) that project plans need to be based on sound estimates.

This difficulty that people have in learning new lessons is well explored by Argyris (1993), who argues that people who are successful and attain positions of power in an enterprise, are naturally resistant to genuine learning because it involves risk, and threatens the very psychological and emotional foundations of their personal achievements.

General management literature, on the other hand, is conducting lively discussions about “learning organisations” (e.g.Senge, 1990; de Geus, 1997) which see learning as a continuous process.

There are some recent indications that the significance of organisational learning to projects (and vice versa) is being recognised, with projects being cited as good vehicles for organisational learning (Yeo, 1993; Bowen et al., 1994). There is also a recognition of the need to embed continuous learning into the project-based organisation either through systems thinking (Ramsay et. al., 1996) or through some other structured process (Crawford and Price, 1996). Hamilton (1997) recognises the importance of systems thinking to projects and project management, and Senge is perhaps the most notable publicist for the discipline of system dynamics (the “Fifth Discipline” of the title of his best-selling management book), which is rapidly becoming recognised as a cornerstone of the “learning organisation”.

As a discipline, system dynamics is beginning to be applied to project management for example by Abdel-Hamed and Madnick (1991) who developed an integrative system dynamics model of software development project management, conducted a case study to test the model, and used the model to study and predict the implications of an array of managerial policies and procedures in order to investigate the general process by which software development is managed. More broadly, Rodrigues and Bowers (1996) acknowledge the rarity of the application of system dynamics, and suggest that it allows “general strategic lessons” to be “considered when planning the project and producing the estimates for the traditional analyses.” Specific examples of “hands-on” predictive risk management through the use of system dynamics models for project simulation have been developed by Pugh-Roberts and described by Cooper. (1993; 1994).

Theme 2 (Topic 6): Practices relating to the stages the project will need to pass through

Since virtually all definitions of a "project" agree that it is a piece of work with a definite start and finish, it is not surprising that nearly all of the classic project management texts devote ample space to a study of how a project develops during its transitory life - the project life cycle. It has been argued that it is the life-cycle that gives a project its unique characteristics: -

> *"The primary reason for the complexity of the implementation function has to do with the dynamic nature of systems. Solutions to complex problems, once decided upon, are not immediately available. …… The systems which are the proposed solutions to problems go from state to state as they evolve from idea to proposal to fruition."*
>
> *(Cleland and King, 1983, p. 237.)*

More generally, however, it is seen as a means of breaking the project up into manageable phases of work.

> *Organisations performing projects will usually divide each project into several project phases to provide better management control and appropriate links to the ongoing operations of the performing organisation. Collectively, the project phases are known as the project life-cycle.*
>
> *(Duncan, 1996, p. 11.)*

Morris relates the life cycle to the essential skills of a project manager in the new project management environment; a point that he illustrates with nine examples of different life-cycle models.

> *A crucial skill of the project executive is to move the project at the appropriate pace through its development cycle, doing the right thing at the right time (not too soon) …. Through careful planning and decision-making. (Morris, 1994, p. 244.)*

Several writers (such as Turner (1993); and Duncan (1996)) make the point that different industries adopt different life cycles that are appropriate to their own particular characteristics, such as defence acquisition, construction, pharmaceuticals or software development. The last-named industry is interesting because of the range of radically different life cycle models that have developed since the early 1980s, and which now co-exist side-by-side. Redmill (1997) points out the strengths and weaknesses inherent in each of the three most widely accepted types (waterfall, V and spiral) and urges project managers not to forget or to ignore the approximations and limitations of the particular model they are using.

Interestingly, there has been a much greater focus in the literature on the activities connected with the early stages of the project life cycle than with those in the closing stages. Project startup, in particular, has been the subject of numerous conferences and articles.

On the other hand close-out, ("the completion of work on a project"(Hougham, 2000)), project close-out ("the full completion of a project signed off by all responsible parties and the finalization of all paperwork" (Wideman, 1995)) and hand-over ("the completion of the project to the satisfaction of the sponsor and the introduction of the product or service being delivered by the project"(Dixon, 2000)) receive scant attention, even though lip-service is paid in most textbooks to their importance.

Theme 3: Practices relating to "beneficial change" that the project is intended to accomplish

In parallel with the growing recognition of the relevance of project management to many aspects of business life, there has been a growing recognition that project management is often used as an engine for strategic change. As such, project management can be seen as quintessentially about managing change.

Barnes (1990) argues that project management can be defined as the "identification and implementation of beneficial change". Turner agrees:

> *Now, in the 1990s, customers want novelty. No one buying a new product wants last year's model. Product development times and market windows are shrinking, requiring new products to be introduced quickly and effectively. Organisations must adopt flexible structures to respond to the changing environment.*

> *In this new environment, all managers - either by themselves, or through teams of people working for them - must manage change through projects. Project-based management has become the new general management through which organisations respond to change to develop and exploit markets ahead of their competitors, and hence project management is a skill that all managers need in their portfolio, alongside more traditional disciplines.*
>
> *(Turner, 1993: 3-4.)*

Business Process Re-engineering (BPR) is an important discipline for implementing transformational change in an organisation. An entire issue of a leading journal (IJPM Vol. 14 No. 6, December 1996) has been devoted to different aspects of the role that project management can play in BPR. Perhaps this was in response to the apparent indifference of authoritative writers on BPR, who seem far from convinced of the significance of project management to their discipline. Two of the most influential books on the topic (Hammer and Champy, 1993; Davenport, 1993) manage to avoid any mention of project management. In response, Tuman (1996) shows how project management can make a substantial contribution to the success of BPR, providing that the focus is on the right project management practices, but the careful reader of both management literature and project management literature will be struck by the different mental models underlying the two streams of thought.

More generally, Cooke-Davies (1994) highlights the mismatch between the perception of the management of change held by business general managers, and that becoming rapidly espoused in the project management world. He calls for a constructive dialogue between the two differing points of view, and Partington (1996) calls for a more detailed study of the practices of project management as they apply to the management of organisational transformation.

> *The project management literature shows that, although the trend towards the use of a project-based approach to management is recognised as important, it is not yet well-understood and is receiving comparatively little attention, particularly in the form of empirical research into the practice of the management of organisational change projects. …*

> *In the literature on the management of organisational change and the implementation of strategy there is acknowledgement that the principles of project management are appropriate to the management of strategic and other organisational change. Simple project management models are advocated and some pitfalls discussed. However, there is little attempt to distinguish between different models of project management, which are in practice used in different organisational change situations and in different sectors.*[5]
>
> *(Partington, 1996, p. 20.)*

This "disconnect of perspectives" becomes apparent when the corpus of project management literature is contrasted with general management literature. There appear to be dissimilar mental models informing the thought processes of the two communities (the project management community and the business management community), and where there are areas of common interest (such as the nature of teamwork) this could be a contributory factor to the misunderstandings that lead to less than optimal project performance. Turner & Keegan (1999) offer an interesting hypothesis about this disconnect.

One recent study (Wolstenholme, Henderson, and Gavine, 1993) has drawn attention to the consequences of two different communities being engaged on a common task but with dissimilar mental models, and it is reasonable to assume that similar consequences arise in the world of projects in organisations.

Projects are conducted by enterprises, so it is important that the ethos, structures, processes, systems and policies of the enterprise are supportive of effective project management. In the conclusion of Turner's seminal work on project-based management (Turner, 1993), the first element cited for the profile of success is "align the project with the business". This section looks at those elements of a project manager's worldview that are dedicated to ensuring that the project and the business are, indeed, aligned.

The topic will be considered under three headings: -

- Topics relating to the implementation of business strategy.
- Topics relating to the definition, quantification and harvesting of organisational benefits as a result of implementing the project.

- Topics relating to the allocation of organisational resources.

Topic 7: Projects as a means of implementing business strategy

Within the worldview of a project manager, two rather different constructs are vying for supremacy in terms of how an organisation relates the management of projects to the implementation of business strategy. These two constructs, management by projects and programme management, are not mutually exclusive, but they apply different degrees of integration.

The most integrative approach is known as management by projects. As project management has spread beyond the traditional industries in which it first took root, so there has been an increase in the amount of writing about "management by projects" or the "project-based organisation". Indeed, the IPMA's[6] biennial conference in Vienna in 1990 was entitled "management by projects", and it set the scene for much of the subsequent debate about projects.

> *Due to dynamic markets, new environmental and technological developments and changes in paradigm companies have to cope with new challenges and potentials (sic) from the business environment.*
>
> *In order to deal with an increasing business complexity companies use projects as organisation form to perform unique and complex tasks.*
>
> *(Gareis, 1990, p. 35.)*

Gareis argues that this has implications for the structure and culture of the project-oriented company, for project management, and for the management of the whole network of projects. Turner (1993) goes into greater detail, and spells out not only the need to change the organisation, but also the process by which a kind of project he refers to as "PSO" (for people, systems and organisation) can transform the organisation itself. Hamilton (1997) agrees, and develops his whole framework for thinking about projects out of the three themes of management by projects, managing change and systems thinking.

This is echoed, to an extent, in general business writing. One enthusiastic believer in the applicability of project management to the whole of business life is Tom Peters.

> *Arguably, project work was the norm before the industrial revolution. Most activities took place in small, independent shops, and craft and craftsmen were the economy's centrepiece. The industrial revolution changed all that. Skills and tasks were narrowed. And narrowed again. Thousands of people went to work under the same roof. Now, thanks to new competitive pressures, new distributive information technologies and the like, we are, arguably, returning to the craft tradition. The essence of craft is the project. It may turn out that the 150 years from the time of Dickens to 1980 will have been the anomaly. What's normal, on the job or off, will end up being craft, learning, adding value — i.e. the project.*
>
> *(Peters, 1992, p. 222.)*

More typical, perhaps, is the approach taken in a series of articles in Harvard Business Review (Bowen et al., 1994) which stress the importance of development projects firstly to an organisation's ability to renew itself and introduce new products, and secondly as a school for developing organisational leaders.

The less all-embracing approach to implementing business strategy is <u>programme management</u>. The term "programme (or program) management" has its roots in the construction and aerospace industries (Archibald, 1992) and has been used with a variety of meanings at least since the 1950s, when it was used to describe the acquisition of defence systems (Morris, 1994).

> *The idea of a program is not precisely defined, because it must be given a somewhat different interpretation in different organisations. Programs are closely related to the objectives of the organisation. In fact, it is because the objectives of large organisations are often difficult to define that no single definition of a program is satisfactory.*
>
> *(Cleland and King, 1983, p. 162.)*

As project management has moved from its traditional roots into a more central place in the strategic thinking and management of organisations, so programme management is receiving increased attention. Turner (1993) describes how programmes of work emerge from the business planning process, and how each programme can give rise to multiple projects. Together with Speiser (Turner and Speiser, 1992) he also shows that programme management calls for different information systems and control systems than projects. Action research into a major European telecommunications study (Pellegrinelli, 1997) draws attention to the differences between three different “configurations” of programmes, which he refers to as portfolio, goal-oriented and heartbeat. Portfolio programmes are only loosely related, are driven by the need to utilise resources efficiently and to leverage existing knowledge or skills. Goal-oriented programmes are groups of related projects that together seek to deliver a single major business benefit (as discussed above under “management of change”). Heartbeat programmes are groups of related projects that enable the regular and incremental improvement of business systems, infrastructure or processes. These classifications seem to represent a helpful advance on less structured or more theoretical attempts to classify programmes, e.g. (Ferns, 1991); (Gray, 1997).

The <u>project context</u> plays an important part in determining just which elements of the project manager’s worldview will require attention. For example in organisations that are operating essentially as suppliers, whereby the business as a whole can be seen as a collection of projects, the question of <u>sales</u> and <u>marketing</u> of projects forms an important element in the implementation of the organisation’s strategy. Thus, these two topics occur as core elements in the project managers’ worldview.

Topic 8: Defining, quantifying and harvesting organisational benefits as a result of carrying out the project.

The term “benefits management” is a relative newcomer to the project manager’s vocabulary. Many classic texts make no direct mention of the subject (e.g.Cleland and King, 1983; Morris, 1994; Kerzner, 1998b), and BS6079 ((BSi, 1996)) is silent on the topic. Following Turner (1993) the definition of a project adopted in this thesis includes the recognition that the product or service being created or modified by a project has as its purpose “beneficial change”. By implication, the only reliable means of testing whether this has been delivered or not is to measure the benefits that accrue. Benefits management, therefore, can be defined as “the identification of potential benefits, their planning and tracking, the assignment of responsibilities and their actual realisation.” (CCTA, 1994, p. 1.)

This omission from the sphere of attention for project managers begs the question of whether this is simply another case of the differing worldviews of general managers and project managers. Support for this view would appear to come from a series of "guidelines written for CEOs and their management teams" about the procurement of information systems (The BuyIT Best Practice Group, 1996). Two of the eleven published guidelines - those dealing with planning and ensuring delivery of business benefits - are annotated "This Guideline is primarily for the CEO and the Board". It would appear, however, that key elements of this message are missing their mark. A recent study into the implementation of new, complex software packages concluded that:-

> *the sheer difficulty and complexity of undertaking large package implementation projects and making the associated business changes is such that all-too-often the business benefits that were sought are not obtained. …….. whilst 89% of respondents claimed their projects were 'successful' or 'highly successful', only a quarter had actually obtained and quantified all the planned benefits.*
>
> *(KPMG, 1997)*

At the heart of the concept of benefits management lies the <u>business case</u> - "a document that defines why the project is required and what the change is to be. It should include an outline of the project's objectives, deliverables, time, cost, technical, safety, quality and other performance requirements, and the major project risks and upside opportunities. It might also include information on the competitive impact, resource requirements, organisational impacts, key performance indicators and critical success factors of the project and its outcome. The project's sponsor, the person responsible for defining and developing the project against the business case, should 'own' the business case." (Morris, 1999)

<u>Project appraisal</u> is "the discipline of calculating the viability of a project. Project viability is normally determined in largely economic or financial terms. However, it is normally extended to include issues such as environment appraisal and certainty of performance." (Project Manager Today, 1997) As such, together with the business case, it lays down the foundations for expectations of the benefits that a project is designed to accomplish.

In theory, therefore, the success of a project is decided primarily upon the extent to which it delivers the benefits. The KPMG report quoted above (KPMG, 1997), however, raises the suggestion that this is far from typically the case. Managers apparently judge projects to be successful on grounds other than the measured and verified benefits that they deliver. Perhaps this is less surprising than it sounds. In the paper previously cited, De Wit (1988) suggested that the whole issue of measuring the success of projects is “so complex as to be virtually impossible.” Certainly, even where there are apparently straightforward goals, such as profit maximisation, secondary goals such as reputation (for example through donating money to charity) may play their part.

There is the additional complication that because objectives are often vaguely stated the relationships between the organisation’s activities and its objectives are seldom precisely understood.

Another way in which the measures of project success are dealt with by implication rather than explicitly in the literature, is by grouping the whole discussion together under “project goals” or “project objectives”. This is the assumption underlying project management self-measuring tools such as the project implementation profile (Pinto, 1990), which includes both the ‘softer’ behavioural elements of project management, as well as issues that Pinto has previously identified as being strategically important in ensuring project success (defined as achievement of the project objectives or goals).

Turner (1993) dedicates a whole section of his book to “Managing the Project Objectives”, with separate chapters on scope, project organisation, quality, cost, time, risk and structuring the plans. In this final chapter, Turner recognises that frequently the five objectives will be in conflict with each other, and advocates clarity about which takes precedence. Whether such clarity can be obtained, or not, begs further questions about the ability of an organisation to articulate and prioritise the project objectives, in view of its “vaguely-stated” organisational objectives.

The final element of the project manager’s worldview relating to benefits management is the <u>post-project evaluation review</u>. This is “an important review of project performance and lessons that can be derived from the project [that is] conducted once operations have started. Although often considered only after completion of the project, in practice project evaluation can and should be a fully integral part of the project. Similar reviews should therefore also be carried out periodically during the course of the project, with the resultant information/lessons fed back into this and other projects." (Morris, 1999)

Topic 9: Allocating organisational resources to the project

Projects require resources of all kinds in order to manufacture and deliver the products or services for which they have been established. Resource planning and resource management, as have been discussed above, are two major concerns in planning and organizing the work to be done. The key elements of the project manager's worldview that bear most closely on this topic, however, concern money and people.

Depending upon a successful project appraisal, finance will be provided by the "owner" of the project, in the expectation of receiving some return from the product or service (see the discussion about uncertainty above). People will be allocated, both in terms of committed individuals and organisational units, including, primarily, the project manager. The method by which resources are allocated will depend partly on how the organisation chooses to implement business strategy (applying techniques such as programme management – see above), and partly on the organisational structure (see below).

People aspects will be considered more fully below, but a great deal of the literature of project management focuses on the role of the project manager, and the skills, attributes or other competencies that s/he needs to possess.

Theme 4: Practices relating to the people that are associated with the enterprise

Up to this point in describing the "praxis" of a project manager, the emphasis has been on techniques, practices and concepts – what they are and why they are important. The final area to be described, however, is arguably the most important of all – being concerned with the "people" who will actually cause the project to come into being, and who will then carry out all the work necessary to deliver the product or services.

These are basically two separate groups of people: -

- the "stakeholders" who not only bring the project into being, but to a large extent dictate the environment within which it is completed, and
- the temporary team that is brought together to undertake the work.

Before writing about these two sections, however, perhaps a something should be noted about the most prominent member of the temporary team – the project manager. The classic understanding of the importance of a project manager's job was set out in Gaddis's ground-breaking Harvard Business Review article (Gaddis, 1959), which emphasises the need for a project manager to be competent with both the technical and the managerial aspects of the project that s/he is managing. A more recent understanding develops this a little further:-

> *The project manager's role is to create a product. In doing so they have to manage two processes: the process to produce the product, and the process to manage the production of the product.*
>
> *(Hamilton, 1997, p. 212.)*

Gaddis described the "qualifications that a successful project manager [of high technology projects] must possess" as a background in a high-technology, a broad working knowledge of many fields of science, a good understanding of general management problems, and a strong, continuous active interest in developing his supervisors. There is a relationship between the qualities of a project manager and the success of the project and so the topic is of more than a passing interest. There is, however, much work still to be done. An analysis of 29 North American publications dating from 1959 to 1990 (Pettersen, 1991) concludes that although there are trends in skills that emerge, the topic is held back by flaws in the methodological approaches of most researchers and writers.

This accusation cannot be levelled at Gadeken (1994) whose paper is based on a thorough piece of research covering project managers in the defence industry, and demonstrates that six particular competencies mark out outstanding project managers from both their competent colleagues, and successful line managers:-

- Sense of ownership/mission
- Political awareness

- Relationship development
- Strategic influence
- Interpersonal assessment and
- Action orientation.

Gadeken shows how difficult it is to assess these competencies reliably, and points to the need to develop and to calibrate suitable assessment instruments, and it is interesting to observe that assessment centres are one method that is gaining increased acceptance (Gystad and Kuvas, 1994).

The International Project Management governing bodies are making significant strides towards establishing an internationally recognised framework of qualifications for project managers (Turner, 1996; Caupin et al., 1999). This is closely related to the topic of training project managers. Some innovative action-based training programmes (e.g.Crawford and Price, 1996) involving partnerships between industry and academia are being tested and the problems of career progression (Hamilton, 1997) and the threat of professional obsolescence (Rutland, 1996) are both being considered.

After these introductory words, it is possible to move on to consider the two topics that make up the fourth and final theme in a project manager's worldview.

Topic 10: Identifying and aligning the interests of the project "stakeholders".

Who the stakeholders of any project are likely to be depends primarily on the organisation structure. Projects are undertaken by enterprises in order to produce a new or improved product or service. It follows that the organisation structure of the enterprise that is undertaking the projects is an important part of the project's environment, and will have a significant influence not only on the stakeholders, but also on the project manager and other project personnel.

There is an apparent divergence between the focus of writing by organisational theorists such as Handy (1976), Morgan (1986) and Mintzberg (1989), and the approach taken by writers on project management. The former emphasis the adaptation of organisations to their purpose, and relate the cultures, systems and structures to the organisation's situation and environment.

> *Every organized human activity — from the making of pottery to the placing of a man on the moon — gives rise to two fundamental and opposing requirements: the division of labour into various tasks to be performed and the co-ordination of those tasks to accomplish the activity. The structure of an organisation can be defined simply as the total of the ways in which its labour is divided into distinct tasks and then its co-ordination achieved among those tasks.*
>
> *(Mintzberg, 1989, p. 100.)*

Morgan points out the influence of the underlying mental models on our thinking about organisational structure:

> *When we talk about organisation we usually have in mind a state of orderly relations between clearly defined parts that have some determinate order. Although the image may not be explicit, we are talking about a set of mechanical relations. We talk about organisations as if they were machines, and as a consequence we tend to expect them to operate as machines: in a routinised, efficient, reliable and predictable way.*
>
> *(Morgan, 1986, p. 22.)*

In contrast to this emphasis on the fundamentals underlying organisation structure, classic discussions in project management literature concentrate on the influence of different structures on the project manager. Many, for example, compare the degree and nature of authority that a project manager is granted in different types of organisation — often using a typology of organisations that envisages a "spectrum" from functional organisations, through matrix organisations to pure project organisations. A good example of this discussion is taken from Cleland and King:

> *Authority in the project environment flows horizontally, diagonally and vertically. Technical competence, persuasion, negotiation, reciprocity, alliances, and the resolution of deliberate conflict are some of the means that project managers use to augment their legal authority to accomplish project objectives. Thus, the effective authority of project managers is political as well as hierarchical.*

> *Conflict in a matrix organisation is intensified by the project-functional interface. Such conflict, properly managed, can facilitate the decision process in the management of the project.*
>
> *Differences of opinion in the project-functional conflict can ultimately be resolved by the common line supervisor; however, the program manager's and the functional manager's credibility will ultimately be reduced by continued use of this alternative.*
>
> *(Cleland and King, 1983, p. 345.)*

More recently, as many organisations have adopted flatter hierarchies and more decentralised structures, and matrix management has become a de facto norm, articles and papers have addressed the specific challenges faced by project managers in these new organisational forms, e.g. (Selin, 1991; Robins, 1993)

One insight into the different approaches is offered by Parkin (1996), who suggests that the decision-making processes of project managers are different from those embedded within the norms of most organisations. There appears to be more to it than this, however, and the theme of miscommunication between enterprise management and project management is one that will recur in this thesis.

A second influence on the project stakeholders is the organisational "culture".

The 1980s saw an outpouring of management writings on the subject of culture, with the runaway success of *In Search of Excellence* (Peters and Waterman, 1982) illustrating the extent to which the genre touched the hearts of the management community.

> *These authors have concentrated on what might be called the "behavioural side" of management and organisation. They have argued that the difference between successful and not-so-successful organisations rests with the values and principles that underlie their internal organisation . . .*

> *Organisational culture is the term that has come to comprise this set of behavioural variables that have drawn so much attention. "Culture" refers to the underlying beliefs, values and principles that serve as a foundation for an organisations management system as well as the set of management practices and behaviours that both exemplify and reinforce those basic principles.*
>
> *(Denison, 1990, p. 1.)*

The culture of an organisation, therefore, exerts a strong influence on all the members of the organisation who are undertaking projects in or for it. This was recognised in the 1990 World Congress on Project Management, where one of the four main groups of topics was "Culture and Project Management". The twin messages to emerge from this and subsequent literature are firstly if the culture is unhelpful then it is important to change it and secondly, that irrespective of whether culture helps or hinders, "the effects of culture must be considered throughout the project." (Turner, 1993).

Firstly, if the culture is unhelpful to the achievement of project goals, then the project may need to make some attempt to influence the culture for the better (Haalien, 1994), although this may not be simple (Cooke-Davies, 1990). Cleland and King (1983) illustrate well how certain aspects of corporate culture, notably the attitude and practices of senior managers, militate against the effectiveness of the planning process.

With regard to the need to consider the effects of culture, this will pervade all aspects of the project. The leadership style of a project manager needs to be adapted to the organisational culture (Maylor, 1996). The practices for managing people on the project team will be governed by the company's HR practices (Fabi and Pettersen, 1992), while the nature of projects and the potentially adversarial relationships between different organisations that are party to a contract is likely to create a culture of conflict and stress (Sommerville and Langford, 1994). The impact of an adversarial relationship on cost in the construction industry is well illustrated in a survey of 262 projects, which shows a clear correlation between high trust and low cost, and between low trust and high cost (Construction Industry Institute, 1993a).

The most widely described practice relating to the management of stakeholders is communication, with its associated discipline of information management. A specific set of practices related to one group of stakeholders is industrial relations, defined as "a broad area of responsibility within an organisation that includes human resources management activities and the administration of union agreements and seeks to maintain a positive image for the organisation through public relations type activities." (Wideman, 1999) More generally, the project manager needs to be familiar with all relevant aspects of personnel management.

Negotiation is invariably required of the project manager, as different stakeholders are likely to be pursuing different organisational and personal goals that will need to be harmonized if the project is to succeed. This topic is closely related to the topic of beneficial change, described above.

Topic 11: Creating, leading and managing the temporary team who will carry out the project.

Looking "inwards", as it were, rather than "outwards", the project manager's second "people" focus is concerned with the project team itself. For this reason, teamwork is a prominent element of the project manager's worldview.

Both the PMI and the APM[7] have recently published "bodies of knowledge"[8](APM, 1995; Duncan, 1996) that emphasise how important human resource management skills are to a project manager. This is generally assumed to consist of techniques and skills for acquiring the right staff to work on a project, organising them effectively, communicating with all parties, developing teamwork, delegating as appropriate, exercising leadership, managing conflict, conducting negotiations and developing individuals. Following the PMI PMBOK, Hamilton (1997) points out also that human resource management includes the processes required to make the most effective use of the people involved with the project.

There is a recognition of the value of good teamwork in delivering successful projects, irrespective of the form of commercial contract (Construction Industry Institute, 1993b; Bucero, 1994) and of the damage to project performance that results from poor teamwork (Mansfield and Odeh, 1991). Other writers note how big the gulf can be between theory and practice (Gabriel, 1991), and how many projects fall short of good practice (Tampoe and Thurloway, 1993).

Many texts emphasise both the need to maintain good relationships and effective communications with the "client", e.g. (Kliem and Ludin, 1992; Verma, 1995), and there is some recognition that human resource management is not an activity alongside other activities, but rather a component of how virtually every project management activity is carried out (Kliem and Ludin, 1992).

As has been noted above, writing about teams in the management literature seems to be more advanced than that in the project management literature. In management literature there is a clear recognition that teamwork depends upon subtle disciplines such as "team learning" (Senge, 1990) that have hardly reached the project management literature. In their introduction to "The Wisdom of Teams", (Katzenbach and Smith, 1993) comment on this:-

> *What this book has to say is both obvious and subtle. Many people recognise the obvious about teams. For example the elements of our definition are obvious. But the discipline they imply is not. Moreover, each element has an obvious meaning. But each element also has more subtle implications. And finally, it is obvious that teams outperform individuals. We have researched and written this book, however, because it is not obvious how top management can best exploit that advantage.*

Gadeken has recognised this difference of emphasis (Gadeken, 1996), and pointed out that with an increasing emphasis in the project management world on the creation of multi-functional inter-organisational teams in such practices as partnering or alliancing there are significant implications on the training and development of project teams.

There is also some recognition in the literature of project management about the tendency towards "self-directed teams" that have been favoured in management practice increasingly since the mid-1980s. Kezsbom, indeed, picks up both on the theme of subtlety and that of self-directed teams when she writes: -

> *Theoretically, these "self-directed" teams … manage themselves. Many, in fact, are carrying out the responsibilities and obligations that in the decade prior defined the project manager's role. As organisations continue to adopt a more "self-directed" team based approach, a closer examination of the project manager's role is needed. (Kezsbom, 1994, p. 589.)*

As has been observed above, one specific aspect of the project team that receives a great deal of attention is the project manager herself. "It seems to be accepted in the field that project managers, who evolve in a context made more difficult by the variety and complexity of its of its characteristics – a context characterized by disorder, ambiguity and disjunction between formal authority and responsibility – need to develop skills different from those of their colleagues in functional management. Consequently, it becomes extremely important for the organisation to take these particular requirements into account when selecting a manager who will be able to bring his or her projects to a successful conclusion." (Pettersen, 1991, p. 21.)

The literature contains much about <u>project organisation</u> and <u>organisation design</u>. "Organisation" is a word with a broad range of meanings, but in this context it is taken rather narrowly to mean the structural characteristics of the roles and relationships between different people and groups of people who make up the project "team", in its broadest sense (i.e. including line managers in the enterprise with whom project personnel need to interface). Most writers accept that there is a need for a project manager as a single point of authority, either implicitly, e.g. (Cleland & King, 1983; Turner, 1993; Hamilton, 1997), or explicitly (Morris, 1994; Gabriel, 1997). As was mentioned above[9] most of the debate in literature is about the differing characteristics and relative merits of functional, matrix and project-based organisations, and the influence of organisation structure on the project manager's authority, e.g. (Cleland and King, 1983; Jovanovic, 1994; Morris, 1994).

There is general agreement that the form of organisation chosen plays an important part in determining project success and that the chosen form of organisation should be selected for its appropriateness to the particular project (e.g.Hamilton, 1997). Hence the recognition of organisation design, which is defined as "the design of the most appropriate organisation for a project, including definitions of roles and responsibilities of the participants. The five basic kinds of structure are: Functional , Coordination , Balanced , Seconded, and , Project Matrix."(Project Manager Today, 1997)

Clearly, the softer skills already described above such as leadership and conflict management, and practices such as integration feature prominently in the ability focus the team's efforts on the work that is necessary to deliver the product or service.

2.5 A systemic view of the project manager's worldview

Implicit in the prior discussion connecting the elements of the project manager's worldview, is a set of systemic relationships. The sixty elements have been found to cluster together naturally and logically into eleven "topic" headings, and the relationships between them can be shown diagrammatically as follows:-

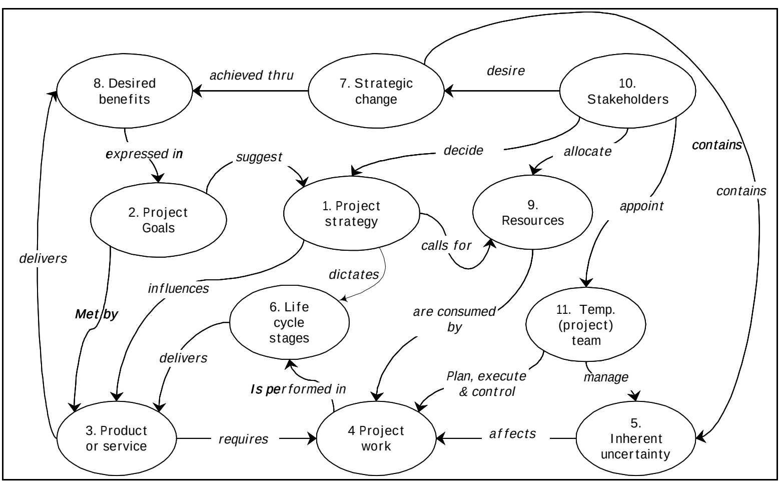

Figure 6: Systemic relationships in the project manager's worldview.

Figure 6 is an important figure. It shows all eleven topics with equal emphasis in a single diagram. There is a logical cause and effect sequence built into the relationships that can be modelled using system dynamics, and that can lead to an understanding of the dynamic behaviour of organisations as they grapple with a multitude of projects, each performing differently both from plan, and from what is necessary to support the corporate strategy.

Each of the eleven topics are shown here in relationship to each other, and all are important to success. But what happens when success is less than complete? In reality projects often fail to accomplish their goals (as was shown in Chapter 1, and is implicit in the growth of the number of people who are explicitly involved in project management) and to deliver the benefits that are expected of them. Thus, a more complete diagram of the systemic relationships is that shown in Figure 7.

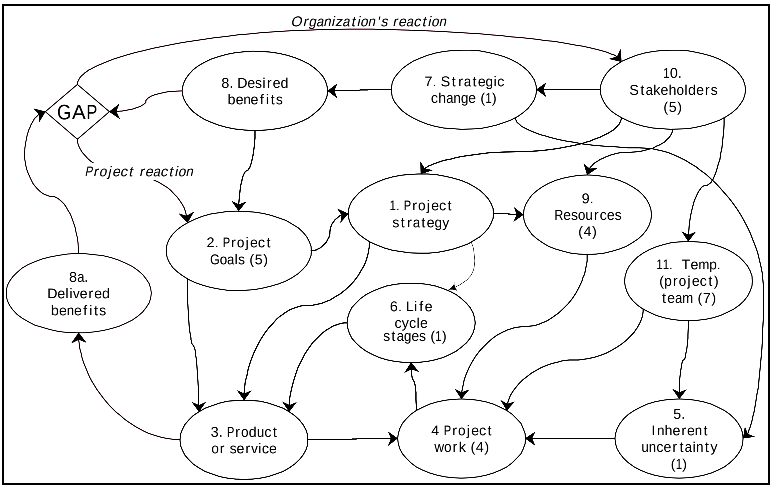

Figure 7: Gaps in the systemic worldview.

The missing "piece" is the divergence between actual (or anticipated) benefits, and the desired benefits on which the project was initially predicated. Depending on a number of factors, the control loop that seeks to take appropriate action to adjust the system in view of the gap might flow through the project team (in which case it is likely to be covered, in the project manager's worldview, by change control), or it might flow through the stakeholders into the whole system, in which case it is less controllable by the project manager. Under these circumstances, the behaviour of the system could well become much less predictable.

In effect, this addition moves the view of project management away from first-order cybernetics to second-order cybernetics. (See Figure 8)

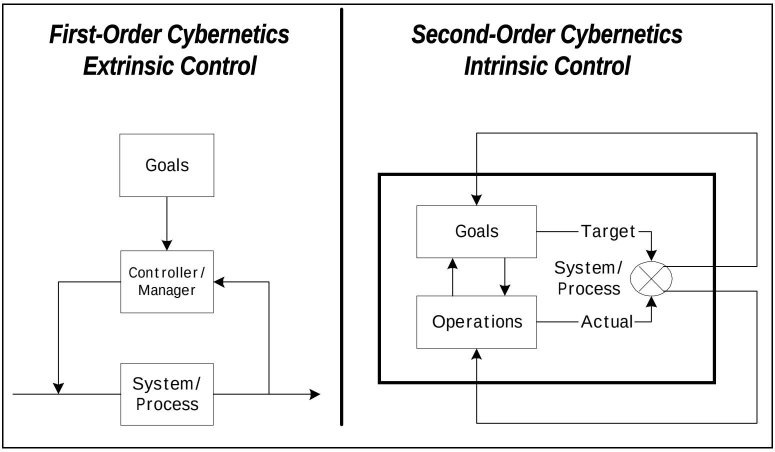

Figure 8: First- and second-order cybernetics (Schwaninger, 1997)

In first-order cybernetics concepts such as feedback, information exchange, control, regulation and equilibrium play an important part. In second-order cybernetics, the multitude of individual perspectives, the observer that in principle cannot be detached from the system and the concept of self-reference, are of central significance. Heinn von Foerster, the pioneer of a new systems view, defined first-order cybernetics as the "cybernetics of observed systems", and second-order cybernetics as the "cybernetics of observing systems". (Schwaninger, 1997: 130-131)

2.5.1 Correlations of empirical research with the systemic worldview.

In terms of “closing the loop” on this chapter, the final piece of work remains to compare the worldview with its implicit cause and effect with the findings of the three sets of empirical research considered at the start of the Chapter. The findings are summarised in Table 4.

Worldview	**Baker et. al.**	**Pinto & Slevin**	**Lechler**
1. Project strategy			
2. Project Goals	Goal commitment. Good cost estimates. Clear success criteria.	Project mission.	Goal changes.*
3. Product or service			
4. Project work.	Planning & control.	Schedule/plans. Monitoring & feedback.	Planning/controlling.
5. Inherent Uncertainty		Trouble-shooting.	
6. Life cycle stages	Few start-up problems.		
7. Strategic change		Project mission.	
8. Benefits			
9. Resources	Adequate funding.*	Top mgmt support.* Technical tasks.	Top mgmt.*
10. Stakeholders	No bureaucracy.*	Client consultation. Client acceptance.* Communication.	Conflicts. Information/ communication.
11. Temporary team	Adequate capability. Task orientation. On-site project mgr.	Personnel.	Project leader. Project team. Participation.

Table 4: Critical Success Factors Related to Worldview Topics

There are four points of particular interest about this table.

Firstly, three of the eleven items are not identified as relating to specific success factors. Two of them ("benefits" and "product or service") are perhaps to do with the traditional distinction between the role of the project manager (manage the project to deliver the product) and that of top management (evaluate which new products or services to invest in) or operations management (operate the product or service to deliver business benefits). The other, however ("project strategy") is less easy to explain, and warrant further investigation, particularly in the light of Miller and Hobbs detailed study of 60 mega projects, which identified alternative "trajectories" (a term encompassing both project strategy and life cycle stages) as the critical determinant of the successful completion of the project. (Miller and Hobbs, 2000) It also appears to fly in the face of evidence collected by the European Centre for Advanced Project and Construction Management (EPCI).[10]

Secondly, the single factor associated with the project's inherent uncertainty is one that flies in the face of much recent writing. Risk management, which accounted for 12% of the journal articles written between 1984 and 1998 a proportion that increased significantly during the period from 1994 to 1998, has as its purpose almost the opposite of "trouble-shooting". As has been seen above, risk management is about proactively identifying threats to the project, and putting in place contingency or containment actions so that "trouble-shooting" will not be necessary. Could it be that this factor would no longer feature so prominently in organizations that have instituted good risk management practices?

Thirdly, there is a general tenor to Table 4 that seems to betray a hidden aspect to the project manager's worldview – one that is difficult to spell out in a sufficiently nuanced manner, and yet one that is leading to a sense of frustration in the academic/practitioner debate about the future of project management at the start of the third millennium of the present era. It has to do with the management of boundaries. Taken in conjunction with the missing elements that are revealed in Figure 7, this might suggest that project management should concern itself with the whole system of projects, and not simply those elements that have been traditionally considered the project manager's areas of responsibility.

The impression that comes across is almost one of, "If I am to do my job properly, then it is important that my project is set up for success by the people who control my external environment – senior management and the clients." No fewer than six of the 28 identified factors could be interpreted in this way (and they have been indicated in Table 6 with an asterisk). If this is correct, then the implication is that project managers interpret their influence and responsibility in a "bounded" way, which leaves responsibility for strategy implementation to others in the organisation. It begs the question of whether this is the appropriate way to maximize the benefits.

Fourthly, there appears to be a mismatch between the research findings on critical success factors, and the hypothesized relationships between the eleven topics that constitute the project manager's worldview.[11]

The third and fourth factors are those that hold most promise for further investigation since, if it is found to be correct, then a recognition of the importance of the currently "neglected" elements of the worldview could lead to a fresh dialogue between the project management community, the general management community and the operations management community.

2.6 How can the search be conducted for improved project management practice?

From the foregoing discussion, it can be suggested that the present worldview of a project manager acknowledges a number of explicit practices that are critical to project management success, and can substantiate their importance through a number of empirical research studies. On the other hand, there are practices implicit in the worldview, particularly those that relate to boundary conditions with other members of the management community and to the behaviour of the whole system when performance deviates from plan, that have been neither validated nor disproved through empirical research. This could be because of the limited focus at the centre of a project manager's attention (managing the specific project), and the fragmented manner in which other important elements of the worldview have been dealt with in the literature.

The task facing the academic project management community, therefore, appears to be firstly to identify theory that might account for both the empirically validated results, and also the "blind spots", and secondly to provide empirical results that shed light on the whole field covered by the project manager's worldview. Such theory is most unlikely to be a "grand unified theory of projects". It is much more likely to consist of helpful "clusters of ideas" that apply in specific contexts to some kinds of projects.

The work on identifying such theory has been started from a number of directions – notably Turner and Keegan from the point of view of classic management theory (Turner and Keegan, 1999), Lundin and others from the point of view of organisation theory (Lundin and Stablein, 2000), Thomas and others from the point of view of organisational learning (Thomas and Tjåder, 2000), and Richardson and others from the point of view of complexity theory (Richardson, Lissack and Roos, 2000). Although not directly related to project management, Wolstenholme's work on system dynamics offers a valuable insight on boundary issues. (Wolstenholme, Henderson, and Gavine, 1993).

The work on which this thesis is based consists of ongoing action research that seeks to make advances in both theory, and the provision of appropriate empirical results.

2.7 Conclusion

This Chapter has reviewed the corpus of project management literature, and extracted from it a narrative account of the way a project manager views the world. 4 themes and 11 topics have been identified that describe the salient features of this worldview.

Empirical research into the factors that lead to project success have provided evidence of the importance of seven of the eleven topics, while being silent on four others, and surprisingly muted on a fifth.

It has been suggested that the reasons for this lie in the self-imposed limitations of the way that many project managers interpret their role with respect to implementing strategic change in an organisation and specifically in defining their relationships with other members of the management community too narrowly. The need has been identified both for theories that explain this shortcoming, and for empirical evidence covering those "blind spots" within the worldview. The remainder of this thesis will concentrate on the empirical evidence – how it can be gathered, how it can be validated, and what it shows..

The next chapter, Chapter 3, will review the epistemological and methodological considerations that must be made in order to have a sound research approach to such a broad topic, and Chapter 4 will describe the programme of action research that has been being pursued since the beginning of 1994.

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[1] Bowker & Leigh Star (1999) demonstrate very convincingly the pervasive influence that classification systems and the associated infrastructure have on all aspects of life today, and this is applicable to the world of projects as to any other.

[2] Under the name of OLC (Operational Level Coordination), this was the second workshop attended by more than 30 practitioners and academics who collectively represent the continuing work on "bodies of project management knowledge" being undertaken by the project management professional associations from around the world. The first was in June 1999 in Norfolk, Virginia. Lists of delegates at both workshops, and the timetable for each as attached in Appendix P-2.

[3] See appendix P-2 for more details.

[4] Earned Value is based on assigning a value to the achievement of project work. Ideally, achievement is in terms of milestone and deliverables. The value is usually monetary but can be expressed in any appropriate units such as man hours. The value to be earned when a specific milestone is achieved is based on the planned cost of achieving the milestone. Thus, for example, if the plan showed that £50,000 was required to achieve milestone X, £50,000 worth of earned value would be credited to the task owner when achievement of milestone X was demonstrated. (BS6079: 1996)

[5] Partington's conclusion is similar to that which led to this research being undertaken.

[6] International Project Management Association, the international body that co-ordinates the national project management associations, formerly known as "Internet" until the term became common coinage for the "information super-highway".

[7] The Project Management Institute and the Association for Project Management are the USA's and UK's National project management associations respectively.

[8] PMI's document is consciously entitled "A Guide to the Project Management Body of Knowledge", since it acknowledges that a single document can never contain the entire Project Management Body of Knowledge (PMBOK).

[9] See the section above on corporate organisation structure.

[10] I am indebted to Per Willy Hetlund for a copy of his recent paper (Hetlund, 2000)

[11] Additional evidence for this has been provided very recently by the growing degree of interest on the part of members of the networks in "benefits management", "programme management" and "portfolio management". All of these topics have to do with the interface between the project manager and other influential stakeholders.

Chapter 3:

3: Research methods and underlying theory.

3.1 Summary

This chapter is the most abstract in a piece of research that has essentially practical aims. It is also, in many ways, the most important chapter in the thesis. As Chapter 2 showed, the literature about project management concerns itself with fleshing out a useful worldview much more so than it does with examining the effectiveness of the worldview using academic and critical tools.

Drawing on modern trends in epistemology, the fundamental issues about knowledge are examined as they apply to both the natural and the social sciences. Both the positivist (or post positivist) paradigm on the one hand and the constructivist (or postmodern or relativist) paradigm on the other are shown to be inadequate tools for the task of critically identifying and correcting the inadequacies in the currently-prevailing worldview about projects.

In order to establish a method that embraces both of these philosophical paradigms and that is backed up by a suitable epistemology, the ideas of three representative thinkers from different spheres of study are brought together. What they have in common is that each occupies the "centre of the philosophical spectrum", and each deals with a different aspect of theory that is necessary to arrive at a well-grounded method. The three elements are the theory of knowledge proposed by Michael Polanyi, the epistemic procedures considered by John Rawls, and the hermeneutic approach developed by Hans-Georg Gadamer. Each suggests different and complementary considerations for the development of a research methodology that might lead to practical improvements in project management practice.

The method is rooted in practice through the intimate involvement of a global project management "community of practice".

An innovative pragmatic research method is described that consists of seven essential components (described Section 4.6) and that contains within itself an iterative and flexible research cycle (illustrated in Figure

12). The cycle itself constitutes a rigorous method of enquiry into the prevailing project management worldview, which takes account of the fundamental epistemic and methodological questions discussed earlier. The participants in the research are all practitioners of project management who are operating within the prevailing project management worldview, and who share a perception that it is capable of improvement.

3.2 Fundamental research issues of philosophy, knowledge, reality and language.

As has been seen in Chapter 2, the largest part of the literature about project management, as well as the thrust of the world's project management professional associations, is devoted to fleshing out and justifying a particular worldview. The challenge facing any research programme such as this one, is to determine the appropriate research method to adopt when conducting a rigorous investigation into a topic as complex as the nature of practices that can help to reduce the high social and economic cost of project failure.

It is necessary to look for a coherent grounding for the research into improved project management practices in part because "project management" lacks a "home" in the academy. Many of the techniques and practices are taught in Engineering departments, and so some research originates there. Business schools and departments of management science also touch on project management, but project managers are not, as yet, recognised by many outside the global community of project management practitioners, and the traditional areas of project management practice (such as engineering, construction, defence and aerospace) as being a "real" part of the organisation structure at a senior level.

Projects don't have a home, but everybody does them. They are a bit like breathing – something everybody does at a sub-conscious level. Goals are created, decisions are taken to pursue the goals, and people are sent off to implement the resulting project or programme. Since the war, and increasingly during the 1980s and 1990s (Kloppenborg and Opfer, 2000), practitioners of project management have sought to raise projects from the sub-conscious and intuitive to the conscious level as they have become more complex and more important, and as the social and economic consequences of failure have become more serious for business.

For this reason, there is an urgent need not simply to advocate more and more sophisticated techniques and practices, but to develop a corresponding body of theory, validated by empirical research that has been carried out using an appropriate methodology or methodologies.

Project management is, as has been shown in Chapter 1, a social construct involving a particular way of seeing a particular enterprise undertaken by a particular group of people. As such, it belongs firmly in the domain of social science rather than of science. On the other hand, many of the products produced by projects employ either the hard sciences (e.g. in the construction of a space probe) or technologies directly derived from the hard sciences (e.g. in the construction of a new building). This means that the realm of project management encompasses both social science and science, and the investigation of an appropriate research methodology must be broad enough to hold a debate with both of these domains.

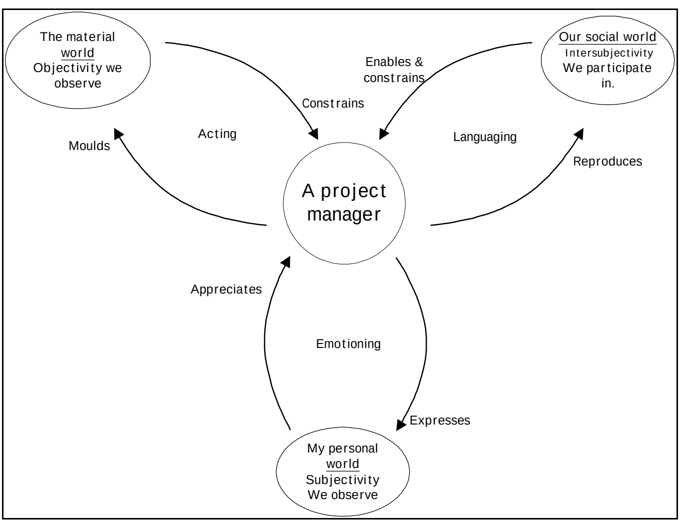

Figure 9: A framework based on Habermas' three worlds. Adopted from Mingers,1997

Indeed, these are not the only two domains to be considered, and the "richness" of a project manager's real-world situation can be seen reflected in a diagram (figure 9) adapted from John Mingers' (Mingers, 1997, p. 10.) adaptation of the views of the postmodern philosopher, Jürgen Habermas.

After a brief review of the philosophical issues, the debate will proceed to tackle such fundamental questions such as, "What is going on when people gain 'knowledge'?" and "How can we be sure that what we discover about project management is reliable knowledge?", "What research procedures are appropriate to project management research?", "What role does the global "community of practice" play in discovering, sharing and creating knowledge?" and "How can these considerations be reflected in a practical research method that will lead to improved project management practice?"

3.2.1 Preliminary considerations of philosophy

Philosophy predates Christianity by a half millennium or so, and for almost as long as philosophy has been practised, there has been a debate about the primacy of reason or the primacy of observed reality. Certainly, Aristotle's critique of Plato's idealism in the fourth century BC has a familiar ring in the postmodern arena. This isn't the time or place to become embroiled in a detailed analysis of the history of philosophy, but the pendulum has swung back and forth from one extreme to the other so often that Hegel's "dialectic" has been accepted by many more people in the West than Marx's application of it as "dialectical materialism".

In the modern academy, the debate about where on its trajectory the pendulum rightly belongs is still experienced in the "paradigm wars" waged between those who are still heavily influenced by the enlightenment project and those who embrace the relativism of postmodernism.

> *Since the beginning of the twentieth century the enormous success of natural science led to its methods (generally denoted as positivism: a belief in universal laws, empirical verification through induction, and observer- and value-freedom) being seen as the most reliable way of generating knowledge, not just in the natural sciences but in the social sciences as well. However, chinks in positivism's armour were apparent within physics itself, with the unavoidable appearance of the observer in Heisenberg's "uncertainty principle". The body blows were provided by philosophers such as Hanson (1958), Kuhn (1970), and Popper (1972) who, in various ways, demonstrated fatal flaws in the cornerstones of induction, and theory- and observer-independent observation. Although this did not have a significant effect on the practice of natural science, it did on social science where it legitimated the rise of various schools of interpretivism such as phenomenology, ethnomethodology, and hermeneutics. During the 1970s and early 1980s similar situations emerged in organisational studies, and in OR/systems with the development of soft OR and soft systems methodology (SSM).*
>
> *Each discipline came to be characterized by a small set of competing and supposedly incommensurable paradigms based around splits between hard, soft and critical approaches. Practical work within the disciplines, whether it be social research or organisational intervention, was expected to occur within a single paradigm, and individual researchers had to ally themselves with one paradigm or another. . . . However, this artificial situation could not endure as researchers and practitioners found that no one paradigm could capture the richness of real-world situations. (Mingers, 1997, p. 3.)*

The realm of management science has, in recent years, begun to grapple with methods that reflect paradigms broad enough to embrace all three of Habermas' worlds.

This Chapter will seek to show that different research methods are appropriate to different philosophical positions and to different epistemic procedures, as shown in Figure 10.

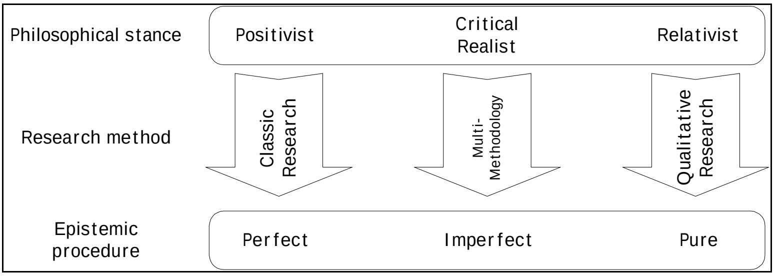

Figure 10: Research methods and underlying paradigms.

The justification for this position will be argued in the next three sections of this Chapter.

3.2.2 What is going on when people gain "knowledge"?

In popular language today, a sharp distinction is drawn between "subjective" opinions and "objective" knowledge. Phrases such as "just give me the facts" give voice to the prevalent idea that somehow "objective" knowledge is of a higher value than the mere "subjective". Ever since the Copernican revolution, science has been seeking to remove "subjectivity" from knowledge, and thus to remove any distortions from man's understanding of the true nature of physical reality.

In the realm of philosophy, the logical positivists such as Russell and Ayer have taken this worship of "objectivity" to such an extent that the positivist school admits as real only such statements as can be demonstrated beyond all doubt. As Russell explains, "The pioneers of modern science proceeded from the observation of particular facts to the establishment of exact quantitative laws, by means of which future facts could be predicted." (Russell, 1937, p.58.) As Drusilla Scott illustrates this. "You see from from your office window many umbrellas in the street below (fact). You suppose it is raining (induction to hypothesis). If so, the street will be wet and shiny (deduction). You stand up and look (test). It is. Your hypothesis is confirmed." (Scott, 1985, p.30.)

An alternative approach has been adopted by Sir Karl Popper, who, recognising that there was something more to the process of scientific discovery than the cold logic espoused by Russell, chose rather to relegate the subjective and creative elements of the process to the realm of psychology.

> *"The work of the scientist consists in putting forward and testing theories. The initial stage, the act of conceiving or inventing a theory, seems to me neither to call for logical analysis nor to be susceptible of it. The question how it happens that a new idea occurs to a man – whether it is a musical theme or a dramatic conflict or a scientific theory – may be of great interest to the empirical psychologist but it is irrelevant to the logical analysis of scientific knowledge. This latter is concerned with questions of validity . . . Can a statement be justified? . . . In order that a statement may be logically examined in this way, it must already have been presented to us." (Popper, 1993, p.31.)*

In other words, logical positivism denies the reality of anything that cannot be subjected to a standard of proof accomplished only in Mathematics, while those who accept Popper's theory of science restrict the realm of what can be known by excluding all the messy areas that involve "subjective" elements.

In sharp contrast to the confidence of science and positivism, the second half of the twentieth century has seen the pendulum swinging back towards a view that is in total contrast to it – a view that is often characterised as constructivism, but that leads to the outlook known as "postmodern". In this view, all confidence in man's ability to know anything about reality is replaced by a deep-seated suspicion that anything that is spoken says more about the speaker than it says about the object which is spoken about. For example, "Roland Barthes (1915 – 1980) exposes the manipulative power-interests which often underlie the 'mythologies' of the second half of the twentieth century. In his *Mythologies* (French, 1957; English, 1972) he unmasks what we too often perceive as 'natural' or 'given' as socially contrived. Many manipulative devices appear to be natural 'truths'." (Thiselton, 1995, p. 14.) This view has much to contribute to this research, but both the recursive nature of Barthes' warning about the hidden motives behind "truth-claims" and also the roots of project management in engineering and technology (both derivative from the natural sciences) each in their own way suggest that constructivism on its own cannot provide the entire context for project management research.

A radical alternative both to positivism and to constructivism is proposed by Michael Polanyi, a physical chemist and philosopher who gave much thought to a comprehensive theory of knowledge that would explain the "how" behind the philosophy of thinkers such as Popper and Kuhn. Polanyi saw great danger in the separation of personal judgement and involvement from scientific method, and he asserted that the devaluing of personal judgement is a self-fulfilling principle, since any faculty that is unused tends to decay. As he saw it, many people have less opportunity for using their personal judgement than was true in the past, and when people are consistently told that their personal judgement is unreliable and irrelevant, they use it even less, so that it does indeed become unreliable and irrelevant. Instead of judging for ourselves, we wait for 'science' to pronounce.

As Polanyi put it,

> *"Backed by a science which sternly professes that ultimately all things in the world – including all the achievements of man from the Homeric poems to the* Critique of Pure Reason *– will somehow be explained in terms of physics and chemistry, these theories assume that the path to reality lies invariably in representing higher things in terms of their baser particulars. This is indeed almost universally regarded today as the supremely critical method, which resists the flattering illusions cherished by men in their nobler faculties." (Polanyi, 1959, p. 74.)*

From the point of view of the general public (including, presumably, many project management practitioners), therefore, the prevailing research paradigm is positivist/realist. But this fails to take account of the actual act of faith that creates the initial worldview that "science" proceeds to investigate. In Popper's words;

> *"From a psychological point of view I am inclined to think that scientific discovery is impossible without faith in ideas which are of a purely speculative kind and sometimes quite hazy; a faith which is quite unwarranted from the scientific point of view." (Popper, 1993, p. 38.)*

If a research method is to be developed for the investigation of project management, therefore, it is legitimate to reject both the extremes of positivism and of constructivism, and to search for a route that lies somewhere in between. What is required is a route that recognises the role of both subjective commitment and of tacit knowledge, while acknowledging that there is an external reality that can legitimately be investigated. An appropriate place to begin the search for such a route is with a review of the relevant epistemological questions.

3.2.3 Epistemic Considerations

Following Popper, it is reasonable to leave out of consideration how the project management worldview arose. Chapter 1 above gives a brief historical overview, and a fuller account can be found in Morris (1994). But regardless of how the worldview came to be formed, the research task consists of seeking to enumerate the propositions that underpin the worldview, and to examine their validity.

The hypothesis that has guided this research programme can be restated in the form of the following six propositions, which together set out the epistemological challenge to be faced.

1. Project management is a coherent worldview about the way people work together to accomplish complex tasks.
2. As such, it embraces a whole set of propositions that people who adopt it are willing to entertain.
3. Project management attracts adherents and practitioners who make assertions from within the worldview to people who may or may not embrace the worldview as a whole.
4. To create, develop and promote a conceptual basis to this worldview, academic research must be built on solid epistemological foundations.
5. Assumptions can only be questioned by accepting others unquestioningly ("a door turns on fixed hinges")
6. To examine the whole world view, it will be necessary to use different parts of the basis as "hinges" for different pieces of research, that nevertheless cohere with each other.

Much of the focus of research into project management could be characterised as an attempt to discover the principles of project management, and much of the project management literature consists of embodying these so-called principles into established practices. Yet behind this element of the worldview is a construct that itself needs to be explored – the assertion that there are some principles available to us to be discovered. But are there? The activity of setting out to discover something assumes that the "something" has an objective existence of its own, and is lurking in some sort of “undiscovered” state waiting for the explorer to come across it. This is a very “realist” or “positivist” thing to do. A good example might be a fundamental law of science, such as the second law of thermodynamics which states that “all energy transformations are associated with an increase in entropy – energy that cannot do work”.

Laws, like principles, exist in language. They are “social constructs” that obtain their “reality” from the fact that numerous human beings agree to their truth and validity. Clusters of constructs form “paradigms”, that in turn influence the way people who adhere to those paradigms view the world. Thomas Kuhn’s seminal work (1996) illustrates the effect this has and has had on “science”.

And yet it seems nonsensical to claim that it was the act of “discovering” the second law of thermodynamics that brought the phenomenon of entropy into existence. The “truth” that the law is seeking to describe is a property of the physical universe – as it were “woven into the fabric” of physicality itself. Both the universe and its properties existed before the law was created in language to describe it. The law didn’t exist before it was “discovered”– the “reality” did.

Another way to put this is that science, as a discipline, is based on a “realist” attitude to the physical universe, but scientists acknowledge the necessary existence of social constructs. Indeed, it is one of the characteristics of the scientific method that all such “laws” are typically held to be true “provisionally”, pending the emergence of experimental evidence that causes the construct to be modified or, indeed, abandoned.

Thus, even within the field of science, the strict “realist” philosophy is mediated into a “critical realist” stance that recognises that our access to and understanding of reality is both incomplete and provisional.

However, other vestiges of the positivist/realist paradigm show less signs of acknowledging the existence of socially constructed reality. The question of the subject and the object remains stubbornly resistant to the inroads of even discoveries made within the realm of physical science, such as Heisenberg’s uncertainty principle. As Lorraine Code puts it so effectively:

> *From a positively derived conception of scientific knowledge comes the ideal objectivity that is alleged to be achievable by any knower who deserves the label. Physical science is represented as the site of controlled and objective knowing at its best, its practitioners as knowers par excellence. The positivist separation of the contexts of discovery and justification produces the conclusion that even though information gathering (discovery) may sometimes be contaminated by the circumstantial peculiarities of everyday life, justificatory procedures can effectively purify the final cognitive product – the knowledge – from any such taint. . . . Claims that there is epistemological insight to be gained from understanding the psychology of knowers, or analysing their socio-cultural locations, invite dismissal either as "psychologism" or as projects belonging to the sociology of knowledge. For epistemological purists, many of these pursuits can provide anecdotal information, but none contributes to the real business of epistemology." (Code, 1998, p. 126.)*

In rebellion against this narrow exclusion of all than that in which the subject (observer) extracts externally valid and verifiable information from an object, Rorty and other post modern philosophers have advanced very strong claims, building on the later Wittgenstein, that the search for foundations of knowledge should look within the "communally created and communally available history, tradition and culture" for the only possible basis of truth claims. "Relocating questions about knowledge and truth to positions within the conversations of humankind does seem to break the thrall of objectivist detachment and create a forum for dialogic, co-operative debate of the epistemological issues of everyday, practical life." (Code, 1998, p. 131.)

There are additional worries in the field of project management, where project teams (consisting of unique groups of people) are struggling in circumstances that will always contain some unique elements to tackle some unique piece of work. The way a personal subject (say an engineer) knows an impersonal object (say a bridge) is fundamentally different from the way that the same subject knows another person (say her supervisor). And the importance of a project manager's knowledge of other people to the practice of project management can be inferred directly from e.g. the section of the PMBOK Guide dealing with Human Resource Management.

> *There is a substantial body of literature about dealing with people in an operational, ongoing context. Some of the many topics include:*
>
> - *Leading, communicating, negotiating, and others discussed in Section 2.4, Key General Management Skills.*
> - *Delegating, motivating, coaching, mentoring, and other subjects related to dealing with individuals.*
> - *Team building, dealing with conflict, and other subjects related to dealing with groups.*
> - *Performance appraisal, recruitment, retention, labor relations, health and safety regulations, and other subjects related to administering the human resource function.*
>
> *Most of this material is directly applicable to leading and managing people on projects, and the project manager and project management team should be familiar with it. However, they must also be sensitive as to how this knowledge is applied on the project. For example:*
>
> - *The temporary nature of projects means that the personal and organisational relationships will generally be both temporary and new. The project management team must take care to select techniques that are appropriate for such transient relationships.*
> - *The nature and number of project stakeholders will often change as the project moves from phase to phase of its life cycle. As a result, techniques that are effective in one phase may not be effective in another. The project management team must take care to use techniques that are appropriate to the current needs of the project.*
>
> *(Duncan, 1996, p. 91.)*

So project management, along with fields such as educational theory and practice, psychology, sociology, anthropology, law, some aspects of medicine and philosophy, politics, history and economics depends for its credibility on knowing people.

This means, in effect, that whatever epistemology is adopted, knowing people is at least as worthy a contender for an underlying epistemological paradigm as a knowledge of everyday objects.

And yet, in the field of positivist/empiricist scientific method, subjects become objects of observation and reliance upon the simple observational paradigms has the consequence of assimilating those subjects to physical objects, reducing their subjectivity and specificity to interchangeable, observable features.

Code, once more:

> *The contention that people are knowable may sit uneasily with psychoanalytic decenterings of conscious subjectivity and with postmodern critiques of the unified subject of Enlightenment humanism.[1] But I think that this is a tension that has, at once, to be acknowledged and maintained. In practice people often know one other well enough to make good decisions about who can be counted on and who cannot, who makes a good ally and who does not. Yet precisely because of the fluctuations and contradictions of subjectivity, this process is ongoing, communicative, interpretive. It is never fixed or complete.*
>
> *(Code, 1998, p. 140.)*

Taken together with Polanyi's identification of tacit knowledge, these epistemological arguments suggest that postmodernism offers some attractive common-sense routes to discovering knowledge about project management. But it leaves the quality of that knowledge open to two challenges:

1. Firstly, there is sufficient external reality involved in the actual enterprise of a project (budgets, durations, physical objects) and so on that any epistemology that is eventually adopted must allow for validation of certain elements against external criteria.

2. Secondly, any truth claims advanced by project management practitioners are open to dispute by people who do not have direct access to the same "communally created and communally available history, tradition and culture." A problem regularly encountered when seeking to convince a sceptical senior management team of the need to change the way business is ordered in order to create a climate for improved project performance!

Each of these two challenges needs to be answered, and the next section of this Chapter will suggest answers to each of them.

3.3 Developing an appropriate research procedure.

Commonly available research methods can be divided into two main groups – quantitative methods and qualitative methods. This creates a dilemma for the project management researcher. Firstly, to take a common-sense approach, three propositions can be advanced:-

1. Projects exist in world of tangible physical objects – products are developed, bridges and roads are built, people work on activities, cash is deposited in banks. All of these characteristics would suggest the adoption of at least a post positivist paradigm, if not a positivist one. One might expect that it would be straightforward to measure activities and outputs and compare them with the results obtained using straightforward and well-established quantitative methods.

2. On the other hand, no two projects are directly comparable. Their contexts, products, services and the people working on them are all different. No two documents produced within a project are identical. Multiple stakeholders each have their own definitions of success. Different project managers each have their own style of operating, so that two people following the same process can have very different motivational effects on their project team members. These and other similar factors would suggest that a constructivist (or some similar relativist) methodology would be more appropriate.

3. It follows that neither the positivist or post positivist paradigm on the one hand, nor the constructivist paradigm on the other are sufficiently comprehensive or rigorous to provide the quality of answer that is consistent with the size of the problem.

Further questions were raised in the discussion about epistemology in the previous section, which cannot simply be answered simply by adopting either a quantitative or a qualitative paradigm. In effect, if research into project management is to be convincing, a new method is required.

John Rawls (1971) makes a useful review of different types of procedures that is extended by Catherine Elgin (1996) into a classification of types of epistemological procedure.

> *A perfect procedure recognises an independent criterion for a correct outcome and a method whose results – if any – are guaranteed to satisfy that criterion. Our independent criterion for the fair division of a cake, let us assume, is that a fair division is an equal one. A cake slicing procedure is perfect, then, just in case it yields an equal division when it yields any division. A finely calibrated electronic cake slicer that partitioned each cake it divided into equally large slices would provide a perfect procedure for fairly dividing cakes. The device would not have to be capable of dividing every cake. It might, for example, be inoperative on geometrically irregular cakes. But so long as every cake it divides is divided into equal sized slices, its use would be a perfect procedure for fairly dividing cakes. An imperfect procedure recognises an independent criterion for a correct outcome but has no way to guarantee that the criterion is satisfied. The criterion for a correct outcome in a criminal trial is that the defendant is convicted if and only if he is guilty. Trial by jury, representation by counsel, the rules of evidence and so on, are the means used to secure that result. The means are not perfect. Sometimes a wrong verdict is reached. A pure procedure has no independent standard for a correct outcome. The procedure itself, when properly performed, determines what result is correct. And unless the procedure is actually performed, there is no fact of the matter as to which outcome is correct. A tournament is best construed as a pure procedure. . . . Winning the tournament is what makes a particular competitor the champion.*
>
> *(Elgin, 1996: 26-27.)*

For a position that lies at neither end of the positivist/constructivist spectrum, an imperfect procedure appears to hold the greatest promise. In effect, many scientific procedures, such as argument from induction, are actually imperfect procedures in Elgin’s sense. Truth is its objective, and ampliative inference its means. A large and varied body of evidence is marshalled, statistical techniques are utilised and so on. But the gap between premise and conclusion is not thereby bridged. The conclusion of a sound inductive argument may turn out to be false.

This can lead to a position of despairing scepticism. If the conclusions drawn from imperfect procedures cannot be trusted in all cases, then we can be sure of nothing. But this is not the only appropriate stance. An alternative, argued for most convincingly by Elgin, is that of an imperfect procedural stance in which each and every proposition, even when it appears unimpeachable, is afforded the same provisional credibility, realizing that further findings may yet discredit it.

> *Reasons emerge from a self-monitoring, self-critical, self-correcting activity. Rather than deriving from a static system of uncompromising rules and rigid restrictions, they belong to and are vindicated by a fairly loose and flexible network of epistemic commitments, all accepted for the nonce as the best we can do, each subject to revision or revocation should defects emerge or improvements be found. . .*
>
> *Being our best guesses as to how things stand, our considered judgements are initially credible. Should they prove inadequate, we round them out with hypotheses and hunches that we have less faith in. Clearly the method is risky, for considered judgements can be the repository of ancient error; unsupported hypotheses may be insupportable; hunches, wild. . . .*
>
> *Still, justification is not circular, since some elements possess a degree of initial credibility that does not derive from the rest. Justification is holistic. Support for a conclusion comes not from a single line of argument, but from a host of considerations of varying degrees of strength and relevance . . .*
>
> *The aim of the enquiry is a broad and deep understanding of its subject matter. And a measure of the adequacy of a new finding is its fit with what we think we already understand. If the finding is at all surprising, the background of accepted beliefs is apt to require modification to make room for it; and the finding may require revision to fit into place.*
>
> *(Elgin, 1996: 34-35.)*

The German philosopher Hans-Georg Gadamer developed a general account of knowledge which is consistent with Polanyi’s, which arose from a totally different context, and which embodies precisely such an “imperfect procedure” as is argued for by Elgin above.

Gadamer’s context was a study of hermeneutics, which is an exploration of the problems of ascertaining meaning in works of translation and interpretation. Nobody interprets a text “in a vacuum”, as it were. Every reader already possesses a set of prejudgements arising from their personal historical and cultural background, as well as their unique individual experience. The actual interpretation of a text arises from a kind of “backwards and forwards” movement between the reader and the text, whereby the text challenges and modifies the prejudgments, which in turn illuminate the text itself. This movement has been called "the hermeneutic circle."

The epistemic problem reframes and supplements the first challenge that was raised in the previous section; "how can a reader ever know if her interpretation is correct, given the ubiquitous presence of prior prejudgements?" becomes "how can a project management researcher ever know if his interpretation of research data is correct, given the ubiquitous presence of prior prejudgements on the part of all research participants?"

> *"The hermeneutic task becomes automatically a questioning of things and is always in part determined by this. This places hermeneutic work on a firm basis. If a person is trying to understand something, he will not be able to rely from the start on his own chance previous ideas, missing as logically and stubbornly as possible the actual meaning of the text until the latter becomes so persistently audible that it breaks through the imagined understanding of it. Rather, a person trying to understand a text is prepared for it to tell him something. That is why a hermeneutically trained mind must be, from the start, sensitive to the text's quality of newness. But this kind of sensitivity involves neither "neutrality" in the matter of the object nor the extinction of one's self, but the conscious assimilation of one's own fore-meanings and prejudices. The important thing is to be aware of one's own bias, so that the text may present itself in all its newness and thus be able to assert its own truth against one's own fore-meanings." (Gadamer, 1985, p. 238.)*

Gadamer argues that, far from trying to eradicate all prejudice, the hermeneutic task is to make the prejudices visible.

> *"It is the tyranny of hidden prejudices that makes us deaf to what speaks to us in tradition. . . . The recognition that all understanding inevitably involves some prejudice gives the hermeneutic problem its real thrust. . . . And there is one fundamental prejudice of the Enlightenment that defines its essence: the fundamental prejudice of the Enlightenment is the prejudice against prejudice itself, which denies tradition its power." (Gadamer, 1998, p. 235.)*

There is no escape from the role of tradition in forming our prejudices, according to Gadamer. So, given the ubiquitousness of prejudice, the real question is "What distinguishes legitimate prejudices from the countless others which it is the undeniable task of critical reason to overcome?" (Gadamer, 1998, p. 240.)

Turning to what he calls the "human sciences" (roughly equivalent to the social sciences), Gadamer shows how any particular worldview arises out of a tradition. But this tradition cannot and should not be contrasted with critical reason.

> *The fact is that in tradition there is always an element of freedom and of history itself. Even the most genuine and pure tradition does not persist because of the inertia of what once existed. It needs to be affirmed, embraced, cultivated. It is, essentially, preservation, and it is active in all historical change. But preservation is an act of reason, though an inconspicuous one. For this reason, only innovation and planning appear to be the result of reason. But this is an illusion. Even where life changes violently, as in ages of revolution, far more of the old is preserved in the supposed transformation of everything than anyone knows, and it combines with the new to create a new value. . . .*
>
> *Research in the human sciences cannot regard itself as in an absolute antithesis to the way in which we, as historical beings, relate to the past. . .*
>
> *The significance [of what is being examined in the human sciences] exists at the beginning of any such research as well as at the end: in choosing the theme to be investigated, awakening the desire to investigate, gaining a new problematic. . . .*
>
> *In the human sciences we cannot speak of an object of research in the same sense as in the natural sciences, where research penetrates more and more deeply into nature. Rather, in the human sciences . . . the theme and object of research are actually constituted by the motivation of the enquiry. (Gadamer, 1998: 243-245.)*

In other words, Gadamer concludes that although there are significant differences between the natural and social sciences, there is no completely successful method by which the horizon of particular prejudgements can be escaped. He further concludes that in the social sciences, the role of tradition should not be underestimated.

This is becoming recognised in the field of management science in general, and systems thinking in particular, through the application of multiple methodologies in a single research programme. Instead of the classic shape of research (shown in Figure 11), there is a growing recognition that "intervention and research is not a discrete event but a process that has phases or, rather, different types of activities, that will dominate at different times. Particular methodologies and techniques are more useful for some functions than others and so a combination of approaches may be necessary to provide a comprehensive outcome." (Mingers, 1997, p. 11.)

This is where it is appropriate to move the discussion away from the general nature of the epistemic problems of knowledge to the particular origins of project management as a discipline. As has been seen, project management is a discipline that has been codified as a tradition through the combined experience of project management practitioners – a group that could be considered as a global "community of practice".

The final element in the foundation for the new research methodology, therefore, which also addresses the second challenge raised in the preceding section, can be found in a consideration of the epistemic role played by a "community of practice".

3.3.1 The role of Community in the Acquisition of Knowledge

During the 1990s, a corpus of writing has been developed under the general title of "Communities of Practice". "A community of practice is a group that shares knowledge, learns together, and creates common practices. Communities of practice share information, insight, experience, and tools about an area of common interest (Wenger, 1998). This could be a professional discipline like reservoir engineering or biology, a skill like machine repair, or a topic like a technology, an industry, or a segment of a production process." (McDermott, 1999)

Project management is such a topic, and the informal network of project management practitioners constitutes such a "community of practice".

As Gadamer made clear above, individuals don't learn on their own.

> *"We are born into a world already full of knowledge, a world that already makes sense to other people; our parents, neighbors, church members, community, country. We learn by participating in these communities and come to embody the ideas, perspective, prejudices, language, and practices of that community (Wenger, 1998). The same is true for learning a craft or discipline. When we learn a discipline whether at school or on the job, we learn more than facts, ideas and techniques. We enter a territory already occupied by others and learn by participating with them in the language of that discipline and seeing the world through its distinctions. . . . This perspective is embedded in the discipline and handed down through generations of practitioners. It is part of the background knowledge and accumulated wisdom of the discipline. Architects from different schools approach problems in characteristically different ways. Each school's approach is embedded in the everyday practices of its faculty, shared as they see the logic of each other's thinking. Knowledge flows through professional communities, from one generation to the next. Even though we do most of our thinking alone, in our office or study, we are building on the thinking of others and to contribute to contribute to a discipline, we must put our ideas out into the "public" just stewards for a moment. Even when we develop ideas that contradict the inherited wisdom of the profession, our "revolutionary" ideas are meaningful only in relation to the community's beliefs. They are still a form of participation in that discipline (Foucault, 1970; Foucault, 1975). Despite changes in membership and dominant paradigms, the discipline itself continues often with its basic assumptions and approaches relatively intact for generations. (McDermott, 1998)*[2]

This community, therefore, is both the "custodian" of the project management worldview, and also the group of people who, by the nature of their employment, are charged with delivering the practical results of employing the "worldview" to deliver economic and social benefits through the effective management of individual projects.

The final strand in the development of the new research methodology, therefore, is the creation of an explicit "community of practice" from among those practitioners who, like the world's scientific community, have most to gain by the development of "reliable knowledge" about project management, and most to lose by the perpetuation of traditions that are based in misperceptions and misunderstandings about what is truly the case.

3.4 A new research methodology

Normally in a research programme a particular problem is identified, and then a given sample of knowledge chosen, and the appropriate medium for it decided – what sample, what questionnaire, what interviews are needed? The choice of sample will be determined by the paradigm being adopted, which in turn will have been shaped by the conscious or sub-conscious hypothesis about where the cause of the problem may lie. Once the data has been collected, it is analysed, conclusions drawn, and a report written that may or may not be published and if it is, may or may not be read and/or acted upon.

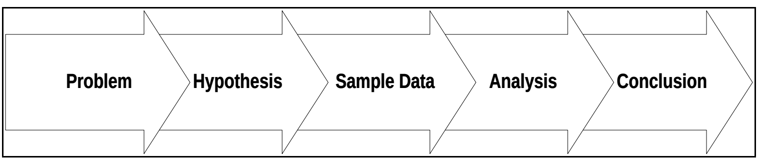

Figure 11: The classic shape of single-paradigm research.

In the previous three sections it has been argued that there is a need to move away from this research methodology towards one that takes more account of the different "worlds" in which a project manager operates, and which makes effective use of the tacit knowledge possessed by the global project management "community of practice". The principles of such a methodology are shown in Figure 12.

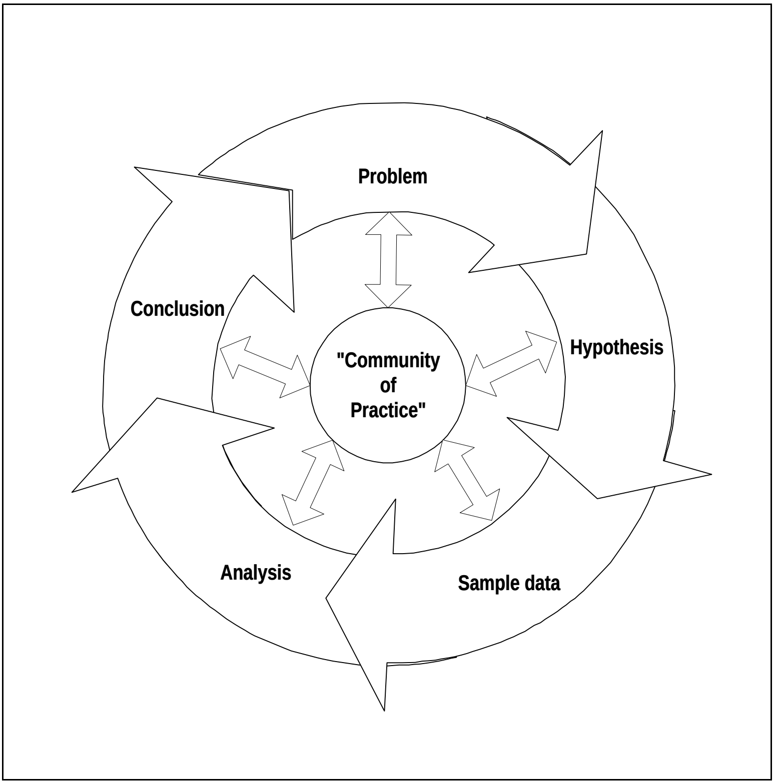

Figure 12: The concept of a continuous research methodology.

The methodology, which will be described below, has evolved over a number of years (as will be described in Chapter 4), and represents a considerable development from the single-paradigm, single-research model of Figure 11. What doesn't happen in the model pictured there is the feedback to change the ongoing data collection process.

The model shown in Figure 12 is actually a new kind of research – a form of "continuous learning action research". Within the loop, there are reflection and people workshops, so that there is a community sharing aspect built into the method. Most research doesn't embrace learning on the part of anyone but the researcher. Dissemination is left to the chance of the library browser – that's where the literature search piece comes from. In the method developed in this programme, learning on the part of the community providing the data is built in.

People come together for the purpose of sharing and discussing, which in turn changes the way the data is collected.

What the research participants are doing is nothing less than developing a new way of doing research that is not only more comprehensive, but is also more productive than classical methods. It builds on classical methods and action research and enhances both of them by continual learning and feedback and replication. It is entirely consistent with the criteria suggested by Mingers (1997).

The novelty in this methodology stems from the combination of a genuine “community of practice” that is a community in more than name alone and that shares both a wealth of tacit knowledge and the commercial motivation to implement changes based on what they learn with the willingness to allow lessons learned using one research method to influence both the design and conduct of further research using other methods. The individual techniques such as case studies, reflection workshops, qualitative analysis, and quantitative analysis are not in themselves novel. Neither is the “action research” focus.

What is novel is the combination of community, commitment, continuity, and collateral (in the form of commonly-held research instruments) leading to creativity and co-operation, that in turn gives the method credibility in the eyes of its practitioners. The value of involvement of people in investigating and developing their own practice is enhanced by the opportunities for learning from practitioners in other organisations that are respected for their standing. Researching and therefore understanding their own performance provides a powerful incentive for change

It should be emphasised that what has been developed is a methodology, rather than a technique. “The difference between a technique and a methodology is that the former insists of a set of prescribed procedures which lead to an end point without need for reflective intervention; whereas the latter embeds a set of techniques and tools within a larger process involving judgement and, commonly, social interaction among participants in the process. One consequence of this is that no two enactments of a given methodology are likely to follow the same analytic path.” (Rosenhead, 1997)

There are seven elements to the research methodology, each of which makes a unique contribution to the whole related to one or more of the epistemic and methodological issues discussed above. In essence, organisations are invited to join a specific research network in return for paying an annual fee.

1. Formal commitment to the network.

The “community of practice” referred to above is constituted formally and legally. When members join the research network, they sign a formal agreement that includes a commitment to provide data and people to the network. The agreement is with a limited number of member companies (usually restricted to a maximum of fifteen organisations) that form the specific network, while agreements also exist to allow co-operation and data-sharing between the whole family of networks. This ensures that the network has resources to operate, and that members can rely on their fellow members to support them in their activities. It also allows the research team to work with members to create a productive climate of trust and to promote a constructive ethos both within the network and also between different networks.

As has been shown above, especially in the discussion of Gadamer’s work, the committed search for reliable knowledge by experienced practitioners is an important precondition for the discovery and creation of that knowledge. The financial and contractual commitment that is entailed in joining the research network is a practical embodiment of this important precondition, and it creates the environment and ethos for effective research.

2. Annual programme of enquiry.

The members of each network themselves decide on an annual programme of enquiry, taking into account their own specific strategic project management needs, the findings of recent reports and analyses, and trends in leading edge project management thinking. The programme encompasses topics for workshops, likely themes for working parties to tackle, data collection commitments members are willing to make, and reports that will be provided. This allows members to ensure that their own needs are reflected in the network’s activities, and to plan the involvement of members of their own project management community.

Project management is a “worldview” – a coherent set of beliefs and assumptions about what is the case as it applies to the management of projects. Practitioners in the very different environments of individual member companies can find their "worldview" restricted by their own environment. The establishment of an annual programme of enquiry by dialogue between all the members of the research network gives the opportunity both to expand and to challenge the "worldview" of any single member, and thus to create new knowledge for them. It ensures both the acceptance and the questioning of tradition.

3. Workshops on specific themes.

Each workshop is thoroughly prepared, and skilfully led. Members who have interesting practices to share provide case study inputs, and the research team's staff prepares original analyses of the network's extensive databases. The workshop structure incorporates facilitated discussions that are designed to discover, share and create knowledge, and the workshop flow is designed to maximise insights for all attendees.

Both quantitative data (e.g. statistical analysis) and qualitative data (e.g. case studies and stories) contribute to well-grounded knowledge about project management. Workshop agendas are developed to provide participants with both formal and informal access to both types of data, and to allow these to be assimilated in an atmosphere that encourages individual and collective learning. The workshops themselves are led in a manner that encourages enquiry and dialogue rather than assertion and the closing of minds.

4. Working parties to investigate topics in depth.

Workshops sometimes lead to the conclusion that a particular topic warrants further in-depth work, and members are invited to volunteer employees to form a working party and to conduct a deeper enquiry than is possible in a workshop. The working party works to terms of reference that are agreed at a workshop, and creates tangible output such as a tool that members can use, a report or a presentation. These outputs are available to all members of the network that sponsors and resources the working party. By mutual agreement, they may be offered to other networks.

The extent of the practice of project management in organisations is increasing rapidly. As the sphere of application expands, the limitations of current knowledge are revealed. Working parties are a mechanism for a group of practitioners with diverse backgrounds but a common purpose to work together to create new knowledge and make it accessible to the network as a whole through the creation of a report, a new "tool" or a thought-provoking presentation. The research team contribute to the working parties their own knowledge of research methods, thus enabling an appropriate procedure such as system dynamics modelling, survey design or case study method to be applied.

5. Extensive databases.

The research networks have been providing data about project management practices since the first network was established in 1994. Every new member on joining the research network answers the Corporate Practice Questionnaire to provide information about project management practices throughout the organisation. Some time later, after trust has developed, members also provide details of the project management practices and strategies applied to specific projects, along with the actual results that the projects achieve. The research staff encodes the data and removes company-specific references so that it can carry out analysis and make inter-company comparisons while protecting commercially sensitive data. Members are provided with software to assist the collection of data. The instrument that is provided to members for collecting project data is known as the "Data Collection Instrument" (DCI), and it provides valuable feedback to the project manager who provides the data, as well as to the network member.

The large databases of secure and anonymous quantitative and qualitative data provide a hedge against the danger of members choosing to see only what they wish to, and thus continually "learning" that what they already know about project management is true. Classification of the data sources by factors such as industry or type of project, the regular introduction of fresh data, and the inclusion of both practice and performance data each increases the potential usefulness of the data as a source for insightful analysis.

6. Analysis and reports.

From time to time, as agreed with members, the research staff carries out fresh analysis of the data that it holds about project management practices and project results. Members can compare their project management practices with other members of their own and other networks, and insightful analysis leads to the discovery of patterns in the data, and to potential modifications to the project management worldview.

Regular analysis and reports are carried out as new data is added to the database, and as new topics for enquiry emerge from workshops or working parties. The analysis might confirm and reinforce “accepted wisdom”, or it may challenge and refute current “knowledge”. In either case, analysis provides the means by which the data stored in the databases is made available for dialogue, and thus for discovering, sharing and creating knowledge.

7. Interpretation of results and support for members’ project management communities.

Every project is to some extent unique, and every member has its own distinctive environment in which projects are undertaken. The research staff provide a number of day’s support to each member to work with their project management community in ways chosen by the member, such as collecting representative data for input to the databases, performing additional analysis of the member’s data, or presenting findings from analysis or outputs from workshops to groups of management.

Company specific interpretation and support extends the process of discovering, sharing and creating knowledge that takes place in the network into the environment of a member organisation. The member’s project management community is effectively engaged in a dialogue with the network as a whole. As a result, not only is there a greater internal commitment to providing reliable data to the network, but there is also an internal process of “making sense” of the knowledge in the particular context(s) of the member organisation’s goals and practices. This can, in turn, create new challenges and questions to be introduced into the network’s knowledge management system via workshops and/or the annual programme.

3.5 Conclusion

A research method that is likely to lead to improvements in project management practice must inevitably employ methods that are appropriate to “social science”. But in spite of being rooted in the social sciences, project management can often result directly in changes to the physical world. Neither a pure positivist nor a pure constructivist philosophy provides a sufficiently rich basis to the research. Similarly, a perfect epistemological procedure will lead to too few reliable results to be useful in practice, while a pure epistemological procedure will lead to conclusions that are incapable of generalisation across the field as a whole.

What has been described in this chapter is a research methodology that has seven explicit components. It has been developed on the foundations of a critical realist philosophy, and employs an imperfect epistemological procedure that draws its strength from the convergence of results obtained from a variety of methods. The methods chosen and the results obtained are subject to the critical review and the combined judgement and experience of a formal community of practice that has been assembled explicitly as partners in the research.

In the next chapter, the first six years of the research programme will be described, and in Chapter 5 a selection from the results that have been obtained to date will be reviewed.

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1 For an example of such a criticism, see Dennett (1992).

2 Quoted from a pre-publication copy of the paper sent to the candidate by its author.

Chapter 4:

4: Developing and applying the new research model.

4.1 Summary

In Chapter 3, the need for a new research methodology was argued, and the characteristics of "continuous action learning" were described. By its very nature, such a methodology has evolved as knowledgeable people (project management practitioners in large companies) have made choices at appropriate times as to what is the appropriate way to tackle specific problems.

A total of more than seventy large private and public sector organisations in UK, USA, Australia, Germany, Denmark, Norway and Sweden are currently taking part in research using the new model, and ten of these have been continuously involved since the beginning of 1994.

The programme was initially established to last for one year, and during this year four of the seven components of the research method were established: a network with committed members, workshops that conducted a structured enquiry into a single topic, the establishment of a database and the analysis of the database. The database consisted of questions on topics common to all members about how projects are undertaken and managed, with scoring performed by the individual member using scoring guidelines provided to the whole network.

During the second cycle, a second database was designed and developed to allow members to compare and contrast the results they had obtained during the first year with the actual measured performance of specific individual projects. As a result of the experiences during this cycle, two further components of the research method were added: the use of member-staffed working parties to undertake in-depth study on behalf of the network, and the preparation of an annual programme of work for the network using a method of decision and dialogue that itself contributed to members' insights into project management practice.

During the third cycle, both databases were refined and expanded, and through detailed analysis carried out on behalf of specific members, the need was recognised for the seventh and final element: interpretation and translation into a member's context. This final element provides, in effect, the link between the research networks (seen as an inter-company "community of practice") and the companies' own internal "communities of practice".

4.2 Three Cycles of Action Research

As was shown in Chapter 1, projects are very important to large sections of industry, and the desire to optimise project performance is great. Unlike repetitive processes, however, it is difficult to compare the results of one unique project with another even within the same organisation. When trying to compare projects across industries it potentially becomes orders of magnitude more difficult.

The absence of research data, however, didn't stop organisations from arguing persuasively that their (often-proprietary) methodology or tool-set for managing projects was superior to the alternatives. Observation of corporate behaviour during the second half of the 1980s and the early 1990s indicated that successive waves of senior management in a single organisation would come up with their own preferred method for improving project performance, and would impose this across the organisation. Sad to say, observation also indicated that the improvements delivered by these solutions fell woefully short of those hoped for by their designers.

With little more basis than this unstructured observation, a number of large organisations to whom projects were important were approached with a proposal to develop an action research programme so that future decisions about changes to project management practice could be influenced by researched data, rather than simply based on the personal intuition and experience of senior managers.

The hypothesis was formulated that different industries were on different learning curves about projects, and so an inter-industry programme was likely to yield richer results than remaining within a single industry. This hypothesis, like the impulse towards the research itself, was based on unstructured observation that project managers in (say) the IT industry were concerned with very different issues (such as customer requirements) than project managers in engineering and construction (who were much more preoccupied with details of contract strategy, for example). It was also considered that competitive pressures would be less in an inter-industry study than in a single-industry one, and so there would be a greater willingness to supply accurate data.

Six research questions were proposed as the basis for the study, which was initially planned to last for one year, but from which the continuous and continuing research method has been developed that was described in Chapter 3.

1) What aspects of project management are common to different industries?
2) Which aspects of project management (such as practices or processes) are sufficiently important to project-based organisations that they are felt to be worthy of measurement across industries?
3) What useful cross-industry "metrics" can be developed to measure the relative performance of these practices or processes, and what constitutes the "benchmark" for them?
4) What evidence is there from actual project outcomes that the "benchmark" practices translate into actual project performance?
5) In the light of project performance, which practices and/or processes can be demonstrated to have a determinative influence on project performance?
6) How can metrics that are relevant to determinative practices or processes be incorporated into useful predictive models?

In the course of developing this method, answers were found to the first three of these questions. They will be set out in the concluding section 4.7.

Although the research programme is expanding rapidly, with activities now involving companies with headquarters on three continents, the development will be described in three cycles of action research, highlighting the research method applied during the cycle, and the contribution that each cycle made to the development of the method overall.

4.3 The First Cycle of Action Research

The action research proposal that eventually found favour with the fifteen blue-chip corporations that became the initial research partners had its roots in benchmarking – defined as 'the search for industry best practices that lead to superior performance.' (Camp, 1989). The term 'benchmarking' derives from 'benchmark', a term used by surveyors to describe ' a mark . . of previously determined position . . . and used as a reference point . . . standard by which something can be measured or judged.'[1]

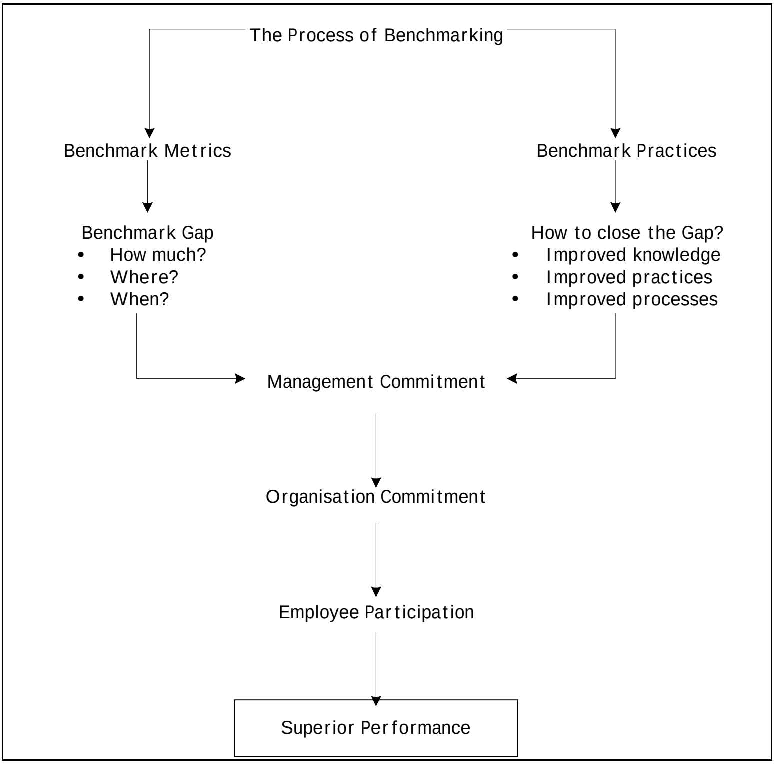

Figure 13: The Benchmarking Process

Benchmarking was the preferred basis for the action research since it allowed organisations in different industries to describe project management practice in their industry, and yet to hold out the hope that some form of standard could be developed to which all industries could relate. Care was taken from the outset to distinguish the discipline of "benchmarking" from the use of "benchmarks". In essence the assumption behind the use of "benchmarks" is that what constitutes "good practice" is already known, and the function of benchmarking is simply to measure one's performance against these known standards.

At the time the action research was being contemplated (during much of 1993) there was considerable pressure being exerted by the Conservative Government to extend the use of so-called "benchmarks" into the domain of the "welfare state", by publishing "league tables" showing certain aspects of the performance of establishments such as schools, hospitals and even government departments. Senior management of organisations in the private sector showed a similar appetite for being able to assess their own operational performance relative to competitors and potential competitors.

It was important to acknowledge from the outset that a good deal of work would be necessary before it became even remotely conceivable to develop a set of "benchmarks" of this sort that would be applicable to projects undertaken in different industries. It was out of these discussions that the recognition emerged of the three different kinds of metrics2 that would be necessary to provide comprehensive benchmarks for project management practices.

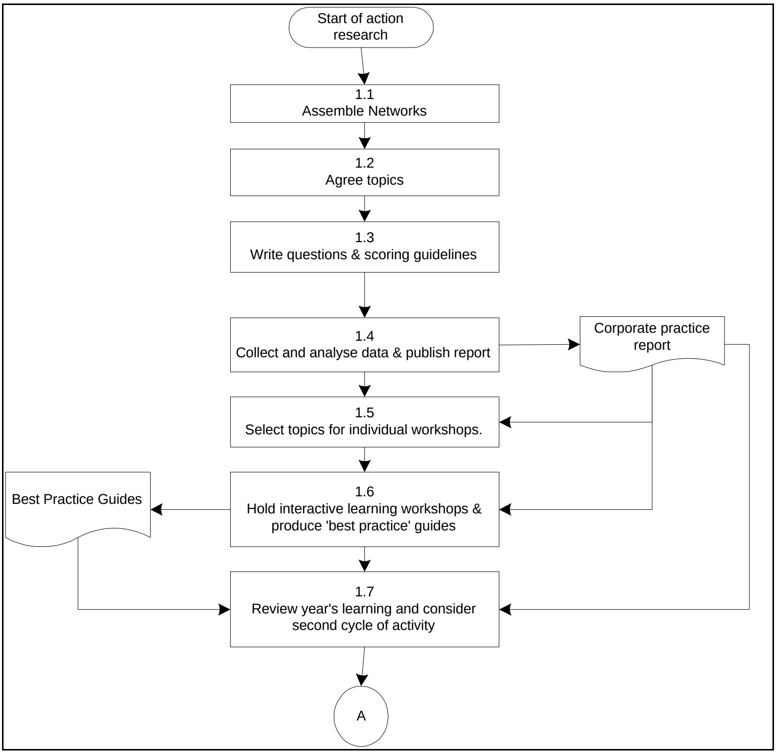

Figure 14: The First Cycle of Action Research

That is, however, getting ahead of ourselves at this point. A method was needed that would enable organisations to embark on a process of learning, and after much discussion with potential research partners, a process was evolved that attracted the support of several “blue-chip” industrial concerns. The method acknowledged that learning about project management practice would be essentially pragmatic and iterative, and yet contrived to avoid both the Scylla of becoming simply a “Talk-Fest” and the Charybdis of producing spurious measures of “whatever is measurable”.

The initial emphasis would be on the right hand branch of the activity in Figure 13, until such a time as it might be possible to prepare more comprehensive “maps” of project management practice.

The initial steps in the action research are illustrated in Figure 14. There were a total of seven steps.

Step 1: Assemble the network

This step consisted of finding sufficient suitable organisations that were willing to undertake the programme of action research, and agreeing "rules" for the programme that were acceptable to each member. It was felt that a minimum of eight organisations would be necessary, with a maximum of sixteen. The upper limit was perceived to be necessary so that workshops (see step 6) would be of a manageable size. Since organisations expressed the desire to be represented by two people, then sixteen members could result in a workshop of thirty-two people – felt to be a suitable maximum.

In view of the goals of the research, it was decided to restrict membership to organisations that recognised the importance of projects to their commercial success, and that saw project management as a key organisational capability.

Step 2: Agree Topics

The point has already been made above that project management at the time the research commenced lacked a clear conceptual framework. This action research is, indeed, itself seeking to provide such a framework. Consequently, the topics that might form the basis for defining "best project management practice" were identified in an iterative process involving both the researcher and workshops for members of the network.

Using a prompt-list provided by the researcher, network members suggested topics that they believed might be determinative for project success, and these were grouped into topic areas with explanations of what each topic consists of.

Step 3: Write questions and scoring guidelines

For each of the topics that had been agreed by the network members, colleagues of the researcher prepared a series of questions. Scoring guidelines were prepared for each question in such a way that a spectrum of scores was appropriate from 0 at one end to 5 at the other. Although there was an implication that in general scoring 5 would imply better practice than scoring 0, that was not an essential presupposition for the process. One of the longer term goals of the research, once suitable metrics had been agreed, was that the appropriate score for each question could be determined. Although not explicitly articulated, there is a tenable hypothesis that "best practice" consists not in doing everything at one extreme point on the scale of measurement, but identifying the optimum level of activity to suit the goals of the organisation, the programme or the project.

Each member organisation was asked to provide two answers to each question: one for the organisation's "approach", and one for "deployment". The approach score related to the theoretical practices "as described in the procedures manuals", while that for deployment related to how the particular practice was implemented throughout the organisation. Alongside each score for both approach and deployment, a written explanation was sought for why the particular point on the spectrum had been chosen by the member organisation.

Step 4: Analyse data and publish report.

The answers to each question were analysed using a combination of textual and simple statistical analysis to provide members with a profile of the scores for each question under each topic, for approach and for deployment, and with a brief description of the practice that appeared to characterise higher scoring organisations in contrast to those assigning lower scores.

Each member was also provided with a graphical representation of how their own scores compared with the network as a whole, thereby enabling them to compare both their own perceptions of where they sat along the spectrum of practice, and what they were or were not doing that was keeping them in their place.

Step 5: Select topics for individual workshops

After a workshop at which the results were presented, and at which member organisations discussed the results in smaller groups, ideas were solicited for topics that members wished to explore in greater depth. A list was prepared for circulation to all members, and each member conducted a "forced-pair" comparison using the Analytic Hierarchy Approach (Saaty, 1990). This produced a list of the five most highly preferred topics, each one of which formed the basis of a dedicated workshop.

Step 6: Hold interactive learning workshops.

A structure was designed for each workshop to enable members to investigate the specific chosen topic in greater depth. A brief summary of the specific section of the corporate practice report was presented, and then three or four organisations that had either scored highly in the section, or had demonstrated in their evidence that they were using particularly interesting practice, gave a detailed presentation on their own practice. This was followed by a question and answer session open to all.

In the second part of the workshop, smaller groups, each with a facilitator, explored in greater depth what they had heard and identified both “pointers to best practice” and “obstacles and difficulties”. Results were assembled on Metaplan boards, a method of collecting input from a group publicly. The people present then weighted the groups’ ideas, to give an idea of the importance that appeared to be attached to each practice.

Following the workshop, the outputs were collated and simplified to produce a specific “best-practice” guide for the particular topic that could be used by individual network members to assess their own internal practice against what appeared to be the best practice available anywhere in the network.

Step 7: Review the year’s learning and consider a second cycle of activity

Following the sequence of seven workshops (one to decide the topics, one to review the corporate practice report, and five on individual topics) the research partners met to consider the year’s activity, and to decide how to progress the research. A “satisfaction survey” was conducted to determine which elements of the research had been of greatest value to members of the network, and it was decided to stay together for a second year of activity.

The nature of the activity changed somewhat, however, as will become apparent. But before moving on to the developments of the second and subsequent years, it is appropriate to pause and to review what had been accomplished during the first year, and the issues that the programme had raised both for the research programme, and for individual members of the network.

4.3.1 Experience gained in practice.

Assembling a network

In many ways, the step of assembling a network has proved to be the most difficult of the seven steps in the first cycle of research. Organisations expressed a number of concerns: that projects in one industry are not comparable with those in another industry; that any basis of evaluation is likely to be subjective; that the organisation is re-organising its project management activity, and thus the time is inappropriate; and that the costs of the activity are more visible than the financial benefits that might accrue from it. Each of these concerns has a justifiable basis, and so answers had to be found before the network could be established.

The question of cross-industry comparability was dealt with by persuading one prominent company (International Computers Limited) to commit themselves to joining the network, to issue the invitation to other selected companies in the name of ICL, and then to use high-level contacts within ICL (at Chief Executive and Finance Director level) to open doors to similarly influential people in the other selected clients. Once sufficient companies were expressing a degree of interest, all prospective members were invited to a workshop in which a facilitated discussion explored the nature and size of projects that each of them undertook, and the kinds of project management issues with which each was concerned. This demonstrated a sufficient level of common interest for each organisation to see the benefits of sharing information across industries.

The question of subjectivity was responded to by establishing clear scoring guidelines for each of the questions that were to be included in the questionnaire, and by developing an agreement between each member and the remainder of the network that each would use their best endeavours not only to provide data as appropriate, but also to protect the confidentiality of each others' data. A governance structure was developed that allowed each member an equal say in decisions about the running of the network in terms of cost, of scope of work and of the admission of new members.

The questions of whether the time was appropriate and if the benefits would be sufficient to justify the costs were handled with reference to the internal goals and ambitions of the organisation itself. In effect, the knowledge that was to be gained would, in itself, have no value. Only when the knowledge was converted into changed practices would there be a financial benefit to member organisations.

As these answers evolved in face-to-face discussions with decision-makers in prospective members, it became clear that enough organisations were being convinced to make an initial network viable. The workshop referred to above established parameters (no fewer than 8 or more than 16 member organisations) and a timescale (cut-off for decisions about membership by December 31st 1993, initial analysis of the data available by March 1994). By the time of the deadline there were 15 members who had signed the agreements. This first network became known as “Europe 1”,since it was largely based in Europe rather than America, Australasia, Africa or Asia.

Defining the programme of work.

Once the number of members and the fees they had agreed to pay were firmly established, it was possible to define the scope of work. This encompasses steps 1.2 to 1.6 in Figure 14. The decision was taken to hold one workshop to define the project management topics that were to be reviewed, one to consider the results of the analysis, and five to investigate chosen topics in some depth – a total of seven workshops.

The initial workshop to define the topic areas used a “Metaplan” process, in which each person present wrote their preferred topics on 20cm x 10cm cards, and these were then publicly presented and grouped together on large pin boards. The topics generated at this first workshop were grouped under 10 headings, which became the “content” of the first cycle of activity. The list of topics was:-

1. Integrating project work into the organisation.
2. Managing human factors on projects.
3. Defining project anatomy.
4. Defining and executing projects.
5. Estimating cost, time and resource requirements.
6. Analysing and managing risk.
7. Managing quality.
8. Monitoring and controlling progress.
9. Closing projects.

10. Measuring project performance.

Identifying and gathering the data

The method of converting these chosen topics into a detailed questionnaire has been described above. What proved to be of interest was the different means used by member organisations to collect their data. Although each member's method was to some extent unique, the overall methods could be grouped into three classes:-

A sole "knowledgeable person", or small group of "knowledgeable people". This method was employed by the majority of the members, with the input coming from either the head of the corporate project support office, or a senior member of staff responsible for project management throughout a significant section of the organisation.

Taking a small group of projects as "representative" of the organisation's overall capability. This approach was adopted by two or three members. In one case, the UK Board of the company took the five most "business critical" projects and answered the questions with reference explicitly to these projects – each of which was under regular review by the Board because of their size and their importance.

Structuring input from a representative group of project managers from throughout the organisation. This third approach was used by at least one of the members, and it involved inviting representatives of each of the 8 geographic regions into a central one-day workshop, at which consensus answers were hammered out.

The data in this first year was provided in written form either on printed forms, or on a word-processing template that they were provided with.

Sharing and learning from the information

When the data had been analysed, and the results were fed back to members both in the form of a report (the Corporate Practice Report), and in a presentation to a workshop, it became clear to the network that different members used similar words to describe different concepts and conversely, that several members described similar concepts using different words. The resulting dialogue proved useful to members in its own right.

Results were presented in two forms:

Firstly, a general report analysed the overall results and average scores for the network, and drew out of the text some comments about those practices that characterised high-scoring organisations in contrast to low-scoring ones. Secondly, each member received a private report that showed them how their scores compared with the mean, high and low scores from the networks as a whole. In order to give some idea of the degree of “clustering” of scores within the overall spread, members were also told in which quartile they performed for each of the ten topics, both for approach and for deployment.

The workshop to present the results was held some weeks after the publication of the reports, and immediately following the workshop members were asked to select five from the ten topics using the Analytic Hierarchy Process. Each of these five selected topics then became the subject of a workshop. The five topics selected were:-

1. Managing human factors on projects.
2. Analysing and managing risk.
3. Estimating cost, time and resource requirements.
4. Monitoring and controlling progress.
5. Managing quality.

The workshop process and outputs was described above in Step 6, but it is worth mentioning that the output took the form of paper-based questionnaires with a scoring sheet and notes on how to interpret the scores that were obtained. The idea was that individual project managers and/or project teams could use these scoring sheets within member’s organisations to assess their own practices against those practices acknowledged by network members to be the best that they had come across. On completion of all five workshops a summary document, “100 questions about project management” was produced in similar format to the five previous documents (referred to by the researchers and network members as “best practice guides”).

One of the network members was sufficiently keen to use these tools that they developed a series of dynamic spreadsheets (using macros) – one for each of the six “documents”, but with an additional culling of the 100 questions.

A customer satisfaction survey was developed and sent to each member – all of whom returned them showing a high degree of satisfaction with what had been achieved during the first cycle of activity.

4.4 The Second Cycle of Action Research: Challenging Perceptions.

This first cycle of activity provided answers to the first two research questions, and pointed the way to an answer to the third one, but it fell far short of the overall research aims. In particular research questions 4 and 5 required us to examine the results from specific projects and from an organisation's project portfolio, and no methodology had been identified for this. Accordingly, a methodology was outlined by the researcher, put forward as a proposal to Europe 1, and accepted by them as the basis for a further cycle of activity. All 15 members continued into this second cycle of activity.

Figure 15 illustrates the second cycle of action research.

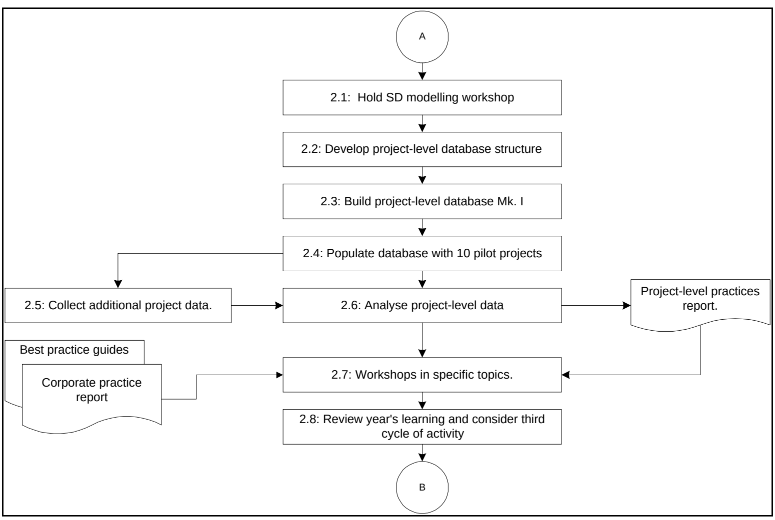

Figure 15: The Second Cycle of Action Research

Step 1: Hold SD modelling workshop.

The researcher and three of his colleagues took part in a three-day system dynamics workshop to provide the basis of understanding which would enable a database structure to be designed for capturing and analysing data on individual projects – how they were managed, and the results that were obtained using these management practices.

The output from the workshop was the conceptual structure for an SD model of the interactions that determine project performance. This model has subsequently been developed, initially by the researcher and Professor Wolstenholme, and subsequently by another of Prof. Wolstenholme's research students.

Steps 2 and 3: Develop project-level database structure and build project-level database Mk I.

The SD model illustrated the dynamics by which practices such as inadequate planning can lead to rework, to incorrect estimation, and through a chain of intermediate reactions to such aspects of project performance as cost escalation and delay. This had to be converted into a database structure that could accept post-project information in such a way that the inter-relationships shown in the SD model could be quantified.

The structure finally adopted is shown in Figure 16.

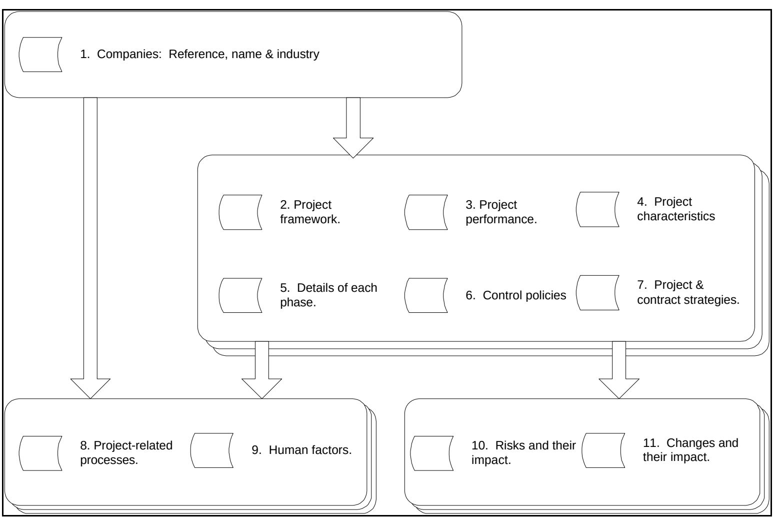

Figure 16: The First Structure of a Projects Database

The database was specified by the researcher, who also designed the basic screen layout. It was then constructed using Foxpro, a commercially available database, and issued to members of the network for their own internal use in capturing data. Definitions of each record and field were provided to members.

Step 4: Populate database with 10 pilot projects

Ten of the fifteen members volunteered to provide pilot data for the database, and the researcher visited their premises and spent a day with the project manager capturing relevant data. In each case specific cost and effort information was unavailable in the requisite form, and needed to be provided subsequently. The pilot exercise, however, demonstrated the viability of gathering the data and of the robustness of the database software.

Step 5: Collect additional project data.

During the remainder of the second action research cycle data was being provided by members of the network, so that by the end of the cycle data on a total of 25 projects had been collected. This data was collected by member’s own employees, using software that was provided by the researcher’s team, and it was then reviewed by the researcher, who investigated any apparent anomalies in direct dialogue with the members’ employee concerned.

Step 6: Analyse project-level data.

The data in this database consisted of a large number of data items on a small number of cases. The analysis, therefore, could not be more than indicative. Consequently, a variety of analysis techniques were used in order to see what possible relationships might be revealed by the data. The sequence of analysis was as follows.

1. Data was exported into an SPSS file, and relationships between numerical data were examined.
2. All non-numerical data was exported into a series of text files, which were, in turn, imported into QSR-NUDIST.
3. Within QSRN, new factors were identified from broad text descriptions, and the whole of the text cross-indexed. Ordinal and nominal data were constructed for the new categories (e.g. number of mentions per project).
4. The new data was produced as text files(to enable exact quotations to be included in the project-level practices reports) and also re-imported into SPSS alongside the original data.

5. Statistical analysis was performed using cross-tabs (exact case) and other methods that were appropriate for providing merely indicative data.

The data was used to construct hypotheses that were then discussed by members of the network at a series of workshops.

Step 7: Workshops on specific topics

After a verbal and written presentation to members on the analysis of the pilot projects, a further selection of topics was made using the Analytic Hierarchical Process. The format of the workshops differed somewhat from the first cycle. A presentation was made on a specific project chosen from among the pilot projects that contained some interesting issues or challenges that bore upon the chosen topic (for example, risk management). In addition, fresh analysis was conducted of all relevant data in both the Corporate Practice Report and the project-level database. These results were fed back to the workshop.

Discussions were then conducted on the specific theme, and insights recorded for individual members to apply in their own organisations.

A final workshop was devoted to a comprehensive analysis of the project-level database (now containing 21 projects), and the implications of the findings.

During the course of this second cycle, a second group of companies (known as Europe 2) commenced a repeat of the first cycle of activity. In the course of this, the corporate practice questionnaire was modified in response to the wishes of the new members. The modifications included the addition of some questions prompted by the workshops on "best practice" during cycle 1, and the introduction of two new topics:-

11. Managing the customer, and
12. Implementing process improvement.

4.5 The Third Cycle of Action Research: Refining the Method

On completion of the second cycle of activity, a further customer satisfaction survey showed that members of the network had mixed feelings about the success of the second cycle in comparison with the first. Specific points that emerged included:-

The presentations on individual projects had been valued very highly by all members.

The project-level database was shown to have great promise, but more projects were needed, and the process of capturing data needed to be made much more simple. Members reported that it was taking them up to 6 days of effort to assemble the appropriate information in a suitable form, and this was too high a burden to place on busy project managers.

There was some feeling that the discussions in each workshop had been somewhat unfocused in comparison with those of the first cycle. The most noticeable difference was that in the first cycle a tangible output had been produced in the form of a “best practice guide”.

In response to these comments, an innovation was introduced into the process. Working parties were established, populated by volunteer employees of member companies, and facilitated by a member of the researcher’s team. Each working party would obtain its terms of reference from a full workshop of the network, and would conduct whatever research it needed in order to complete its task.

A third proposal of work was submitted by the researcher, with an opportunity for members to choose between alternative topics for both the workshops and the working parties, as a result of which a third year’s cycle of activities was initiated. The content contained elements from each of the first two cycles, but was assembled in a different way (see Figure 17). For an overview of the pattern of research activities over a five-year period, see Appendix L-2.

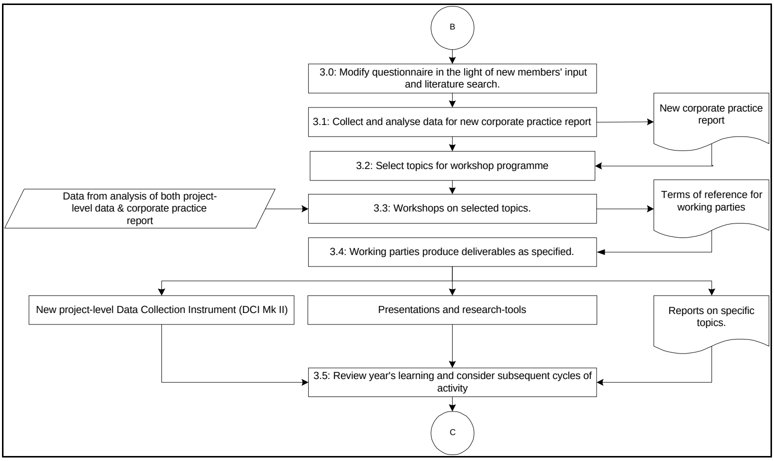

Figure 17: The Third Cycle of Action Research

4.5.1 Developing the Mk II data collection instrument, and establishing the habit of continuous learning.

The members of the two networks that were in existence at the commencement of Cycle 3 were of the opinion that the collection and analysis of data at the level of specific individual projects would provide the key to the research questions 3 to 6 described above[3]. Accordingly, a working party was established under the leadership of the researcher, to develop a suitable data collection instrument and an appropriate database structure. At the workshop to initiate the working party, members had indicated a number of constraints that should be acknowledged by the working party. These included, critically, that the tool and associated database:-

1. Should put specified limits in data collection time (target 30 minutes).
2. Should provide data in a coherent structure that is comparable across industries and for all kinds of projects.
3. Should provide a road map to project managers as to when they provide the data.
4. Should give the provider of data real and immediate benefits (project close-out report, corrective action etc.)

5. Should identify which practices have the biggest impact on project performance.
6. Should enable the quantification of what benefits can be expected from which practices.
7. Should incorporate the best practice findings into the questions and the output.

The researcher proposed a conceptual design that included three elements: a “context” that showed how far advanced the project is in its planning or execution; a “footprint” that provides a visual comparison of actual practices used at a given point in time with optimal practices at that point; and a “log” that kept track of project status and forecasts over time, as well as recording significant events such as changes to project scope or risks that materialised. The full brief of the working party, as subsequently accepted by the network members, is attached at Appendix P-3.

The design method adopted incorporated the G/Q/M paradigm (Rombach and Basilii, 1987). This starts of by defining as clearly and succinctly as possible the goals (G) of the study being carried out, and then develops a series of questions (Q) that will have to be answered if the goals are to be achieved. The answers to some questions are likely to contribute to more than one goal. For each question, a series of metrics (M) are then found that can provide the information necessary to answer the questions. The goals and associated questions of interest are attached at Appendix P-4.

The resulting database structure is as shown in Figure 18.

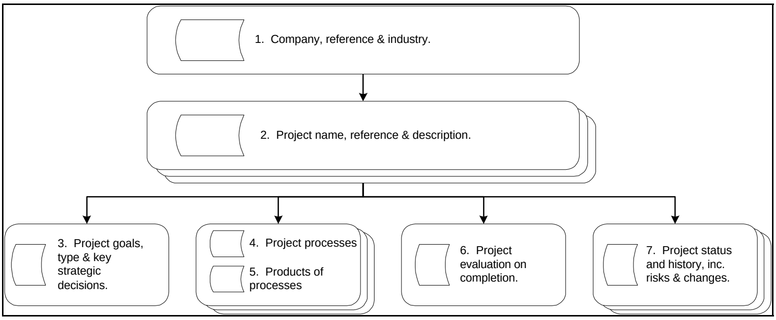

Figure 18: The Second Project Database Structure

Since many of the topics under consideration were likely to concern processes used in the management of the project, it was further decided to use a double scale for the information: one that concerned the adequacy of the product or the output of the process, and one that assessed the maturity of the process.

Out of the design discussions and the implicit theories that appeared to be held by members of the working party (who were drawn from a variety of industries including transport, pharmaceuticals, financial services, telecoms and retail) an analysis structure emerged that was consistent with the data held in the database. It is shown in Figure 19.

The DCI was developed in prototype form by employees of one of the members of the working party (British Telecom), and then refined by a commercial software developer working under the direction of the researcher. It was issued to members in a run-time version of Access, so that any person with a Windows 95 or Windows NT4 workstation could run the tool. Data was exported onto floppy disk in the form of Excel tables, that could then be sent to the researcher for analysis.

In use, a number of members immediately saw the benefits of incorporating such a tool into the day-to-day operations of the organisation, and a further programme of development of the tool was undertaken during subsequent years' operations.

By the end of the third cycle of activity, the prototype tool had been tested and found suitable for its immediate purpose, and data on 25 projects had been provided. These were analysed using statistical methods (basically SPSS-based), and the results were compared with those obtained from the project-level database version 1. The results were sufficiently encouraging to continue into a fifth year of activity, with the collection of data on further projects.

The availability of this tool and its subsequent improvements made it much simpler to obtain data for analysis, and statistical analysis of the resulting output was possible using both SPSS and "Answer Tree" – a development of CHAID that allows scalar, nominal and ordinal data to be analysed together.

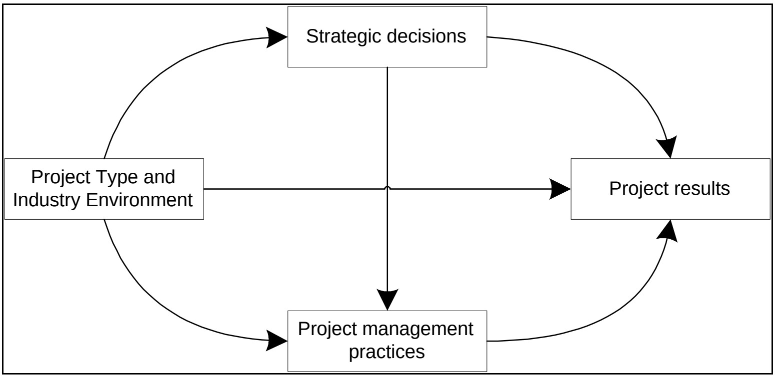

Figure 19: Structure of Project Analysis

The development of the DCI Mk2 v2 followed during the fifth year of operation, in order to improve the usability of the tool, to re-introduce a measure of project scope as one of the measures of project performance, and to enable members to perform a limited amount of customisation. The improved structure is shown in Figure 20.

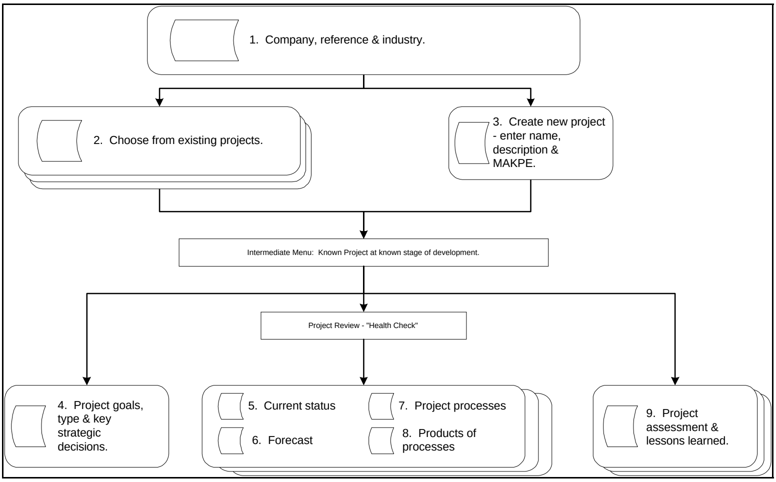

Figure 20: The Third Structure of the Project Database

By this time, a working party had studied how best to measure project performance and members had begun to turn their attention to how to implement the improvements in project management practice that were being identified by the research programme. Member organisations were drawing the attention of their wider project management communities to the action research programme and the results it was obtaining, and so a greater interest was being shown in how to integrate the research into a programme of continuous learning about projects.

4.5.3 Developing the Corporate Practice Questionnaire version 3 and an organisational project management maturity model.

During the fifth cycle of research, it was becoming clear to the research team and to members of the networks that a coherent theory was emerging of the controllable influences on project performance. Two levels of capability could be identified and described firstly as the capability of the enterprise to define, initiate and execute projects and secondly as the capability of the project team (defined in the wider sense) to plan the project and to deliver the products and services required of it. The two capabilities are not independent of each other, and the relationship is shown schematically in Figure 21.

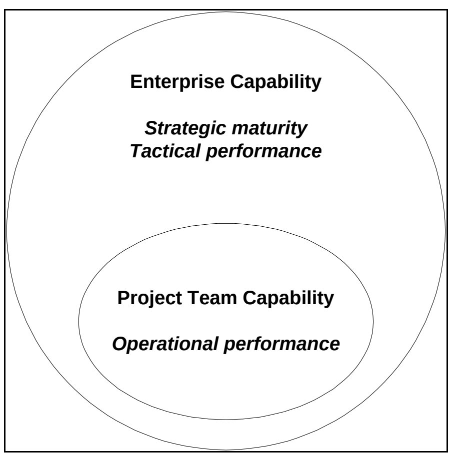

Figure 21: Two Levels of Capability

Accordingly, the place of the two databases (enterprise-level and project-level) and their respective collection instruments (CPQ and DCI) began to emerge more clearly.

The CPQ could be thought of as an instrument for measuring the organisation's maturity in respect of its capability to define, initiate and execute projects. The "approach" represents the "ideal" capability as conceived by the organisation – and the extent to which it has developed a mature strategic approach to the conduct of projects. The "deployment" represents the extent to which the strategies can be implemented tactically across the whole project portfolio.

The DCI, on the other hand, as well as assessing the maturity of specific project-related processes as applied to a specific project and the adequacy of the processes and products associated with planning and delivering the project also captures measures of the project's output performance.

In the light of these constructs, the CPQ version 3 was modified to draw upon all the elements that appear to be significant in assessing an organisations' project management maturity, while maintaining comparability with the two prior versions. The resulting list of questions is attached at Appendix P-5. Analysis of the answers can be anticipated to provide suitable input to the construction of a theoretical "maturity model" for an organisation's project management capability analogous, in some ways, to the Corporate Maturity Model for software engineering developed by the Software Engineering Institute and Carnegie-Mellon University.

With these amendments, there is also the possibility of "triangulating" data between, for example, the deployment scores and evidence from the CPQ and the adequacy and maturity assessments from individual projects using the DCI.

4.6 Adding the Final Element: Interpretation and In-house Support.

By the end of the third cycle of action research six of the seven elements of the research methodology had been developed and validated, at least in terms of the promise that it held out to members and prospective members of the research networks. During the sixth year, 1999, the number of organisations signing up for the networks increased to 56, and the seventh element was added to the research method.

The origins of the seventh element are interesting. As the volume of data published by the research programme increased, the research team received a number of requests from members to make presentations to internal groups of project managers, and the managers of project managers. The presentations covered the concept of the research networks and the work they had done, the major insights that had emerged to date, how the particular member compared with other members of the network, and what that implied for the member's own project managers.

It began to appear as if the people who represented a member company in the activities of the research networks (providing data for the databases, attending workshops, finding volunteers to work on the working parties, circulating reports internally, contributing to decisions about the annual programme of work and so on) were actually operating in the intersection of two separate and distinct "communities of practice"[4]. In effect, the research network is developing its own vocabulary and range of concepts, which certainly overlap but are not identical with the vocabularies and concepts in common use within any single member.

The seventh component of the research method, therefore, consists of a series of activities designed to harmonise the concepts and vocabulary of the two communities in order to enhance understanding and communication.

4.7 Conclusion: The Origins of the Research Method in Three Cycles of Development

This Chapter has traced the development through three cycles of action research of the seven elements of the research method described in Chapter 3, and pictured diagrammatically in Figure 22.

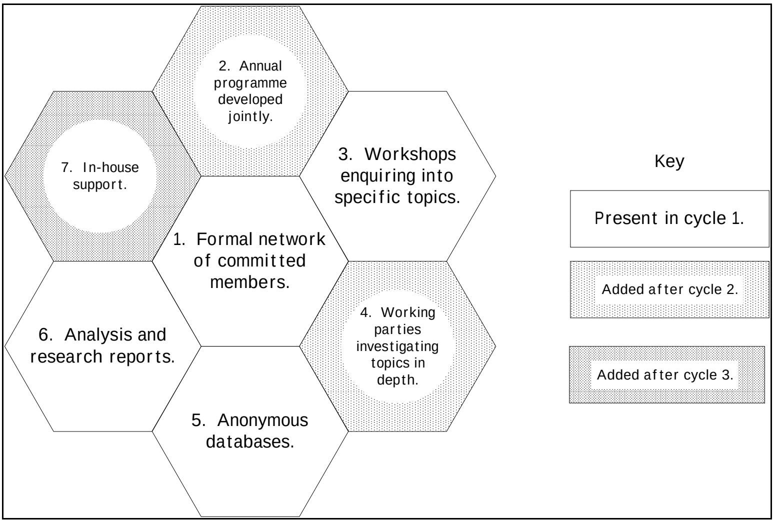

Figure 22: The Seven Components of the Research Method

The method has been developed in action research, and has itself been subject to a form of Gadamer's "Hermeneutic Circle", as members have critically examined the quality of the results being obtained.

The new form of action research that has been developed in this programme is different from and greater than the sum of the individual pieces of research that have been undertaken during the past five years. The elements of the research programme that are novel are:-

1. The commitment of a number of commercial organisations to a long-term programme of co-operative investigation of a complex and difficult topic that has major commercial and economic significance.
2. The creation of a theoretical model that transcends the paradigm underpinning specific research methodologies and thereby allows the long-term enquiry to continue in a way that makes use of different research methods for different pieces of research.
3. The establishment of two different and complementary databases, each collected using different instruments and capable of analysis in a form that is suitable to the nature of the data being collected.
4. The investigation of a series of individual research topics by both workshops (conversation) and working parties (acts of creation)

drawn from member organisations that make use of the existing databases, and conduct additional ad-hoc inquiries of members to supplement the available information.

5. The use of results from individual pieces of research within the overall programme to suggest not only improvements to existing research instruments and methods but also fresh research questions that challenge the existing theories about project management implicit in the current practices and paradigms of the enterprises involved in the research programme.

The programme, as constituted, is unlikely to provide quantified “cause and effect”-type recipes for the conduct of projects, because of the nature of projects and the inherent variability of so many factors that bear upon the results accomplished by them.

In the course of developing this methodology, answers have been obtained to the first three of the six research questions first listed in section1.6, and repeated in 4.2 above.

1) What aspects of project management are common to different industries? *The research confirmed that the full range of topics described in detail in Chapter 2 was of interest to project managers and project sponsors in the wide range of industries represented in the community of practice. The eleven topics listed in section 2.4.4 and covered by the various “bodies of knowledge” have all proved relevant to different industries, and have been confirmed to be important as new networks have formed with members from across the industrial spectrum.*
2) Which aspects of project management (such as practices or processes) are sufficiently important to project-based organisations that they are felt to be worthy of measurement across industries? *The research confirmed that detailed lists of questions from the CPQ (Appendix P-5) and from the DCI (Appendix P-6) were generally necessary and sufficient to measure project management practices over a period of years. The range of topics is the same as that covered in answer to question 1*
3) What useful cross-industry “metrics” can be developed to measure the relative performance of these practices or processes, and what constitutes the “benchmark” for them? *The research demonstrated that practices could be “measured” (or, better, “assessed”)*

> *against a pragmatic scale of measures for each question in the CPQ. This provides a "relative" scale against agreed standards (akin to Rawls' pure epistemic procedure) that allows companies to locate their project management practices relative to other organisations in the same industry, or relative to other organisations with a comparable approach to project management. The evolution of these scales has been described above, and examples can be seen in Table 6 in section 5.3.1 below.*

The answers to questions 4 and 5 will be provided below in Chapter 5, since they are answered through the analysis of data provided by members of the networks. Indeed, the focus of Chapter 5 will be to provide illustrative examples of the data analysis that has been made possible through the application of the methodology to date.

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1 Webster's dictionary.
2 See Figure 3 in Chapter 1 above.
3 See above, page 2
4 The term "Communities of Practice", first coined by Etienne Wenger and Jean Lave (Lave and Wenger, 1991) provides a very useful shorthand for the kind of social theory of knowledge that will be developed in Chapter 3.

Chapter 5:

5: What does the data show? – Illustrative analyses from two data sets.

5.1 Summary

With so much information created in the course of more than six years applying the continuous action research method, this chapter must inevitably be selective in the data that are presented. There is also the requirement to protect commercial confidentiality for the member organisations.

The method in action will be illustrated by describing the different ways in which data is used by the networks, and then by examining two different sets of data (one from each of the two databases that are the twin pillars of the networks' data) that were collected using each of the twin data pillars that supports the method from each of the two ends of the spectrum.

The Corporate Practice Questionnaire (CPQ) is the instrument used by organisations when they first start to apply the continuous action research method. Members of a project management community assess their organisations' practices against a questionnaire with scoring guidelines provided, and from an analysis of the data, they are able to compare their own organisation's project management practices with those of other organisations that are using the same instrument. The metrics produced are "relative", and the descriptions of the practices are "qualitative".

Illustrative results are described for a group of twelve UK companies covering all practices at a high level, and those practices associated with integrating project working into the organisation in more detail. Illustrative results for one of the companies are then shown against a wider sample of data from a total of 45 organisations.

The Data Collection Instrument (DCI) is nearer to the "positivist" end of the method spectrum, seeking, as it does, to compare the management practices employed on specific projects with the actual results obtained by those projects. Quantitative analysis of 136 projects from 23 organisations operating in a range of industries indicates that it

is possible to identify specific practices that bear a significant relationship to project performance, as measured by the predictability of project duration, project scope and project cost.

In the course of this analysis, answers were obtained to questions 4 and 5 of the six research questions first listed in section 1.6. The answers will be discussed in section 5.5

5.2 How data are used by the networks

The two datasets described above as the “twin pillars” are large and growing. For instance, the CPQ data contains 54 current cases (each of which represents an organisation), for each of which there are 284 numerical variables and 278 text variables that contain evidence for the scores in the numerical fields. The DCI contains details on 136 projects, and for each project captures up to 145 primary variables, from which a further 50 are derived.

Before providing illustrative data from each of them, brief mention should be made of the rich variety of other insights that have been obtained from the method, using combinations of data from one or both of these data sets as inputs to conversations among the community of practice. The two “vehicles” for these structured conversations have been workshops and working parties. It has also been possible to produce research papers on specific topics by combining insights from these structured conversations with analysis of data from the two data sets.

5.2.1 Applying the data in workshops

Section 3.4 in Chapter 3 described the contribution made by workshops to the total research process. Each workshop is held on a specific single topic, chosen by the members of the particular network at the start of the year’s activities, in the light of the most recent analyses of the two main instruments, coupled with their own internal project management improvement programmes. Once the topic has been decided, organisations are first of all asked what specific outcomes they would like to see from the workshop, and then when this has been assimilated by the research team, delegates are asked to prepare a specific presentation that addresses the topic under discussion.

Depending upon the topic, the outcomes, and the state of practices known to exist from answers to the CPQ and the DCI, either a limited number of organisations are invited to prepare in-depth presentations based on case studies that are relevant to the topic, or all members of the network are each invited to prepare a brief presentation of their organisation's processes, practices and approach to the topic in question.

The research team prepare a presentation that combines the data held in the CPQ in answer to relevant questions (see appendix P-5 for a full list of these questions) with the data on relevant practices and corresponding project performance from the DCI (see appendix P-6 for a list of the questions on project management practices).

Several insights have emerged from these workshops, in addition to the conclusions highlighted later in this chapter, and some of them are listed here. These have in turn influenced subsequent working parties, and the design of subsequent versions of the two data collection instruments.

- In a workshop on "monitoring and controlling progress", three organisations that scored highly in the relevant section of the CPQ (17 questions in section 10 in appendix P-5) gave well-presented case studies of how project control was exercised. From the ensuing conversation, it was concluded that organisations were much more consciously aware of the processes for gathering and distributing information about progress much more than of the actual mechanisms of control. When questioned in detail, the organisations concerned concluded that it was "left largely to the project manager, unless the variances were so large that a senior level of management decided to intervene". (See section 2.5 above for a more detailed discussion of how this comes about).
- In a workshop on "estimating time, cost and resources" (12 questions in section 8 of the CPQ in appendix P-5), a discussion on the difference between the official "approach" adopted by an organisation and the actual "deployment" revealed the existence of multiple estimates arrived at for different purposes. There can often be a difference, for example, between the estimate on which a sales person bases their bid to a prospective purchaser, the estimate used as the basis for procuring major elements of the project, the estimate used to senior management for the purpose of securing approval, and the estimate used by the project manager for

forward-looking control. The implications of these differences were explored.

5.2.2 Building on the data in working parties

Section 3.4 of Chapter 3 described the role of working parties in developing insights and knowledge, when it became clear that further work of a sustained nature would be beneficial to an understanding of improved project management practice. An example of a working party's "terms of reference" is shown in appendix P-6, and the outcomes of that working party allowed the data analysed below in section 5.4 to be collected. Two other working parties may be cited as illustrations of how knowledge can be deepened or created.

- The first topic to be investigated (during 1996) was the process of transferring lessons learned from one project to another. The working party mapped out in detail a process that has four broad steps, and that represented the most common approach in use by members (see figure 23).

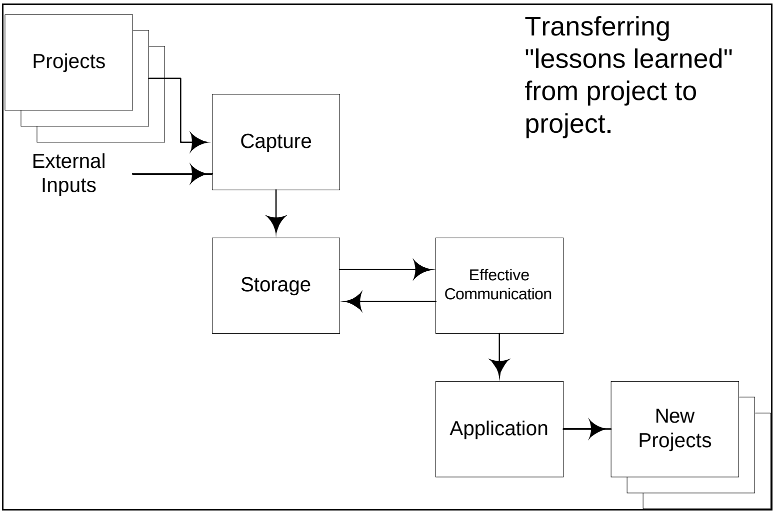

Figure 23: Transferring 'lessons learned' from project to project

The working party also developed an assessment instrument to measure the effectiveness and extent to which the various process steps were carried out. They concluded that whereas the process steps associated with the capture of lessons learned (post project reviews and the like) scored over 70%, this deteriorated to 65%, 58% and 25% for the remaining steps.

A discussion of the implications of these findings was presented at PMI Symposium in October 1999 (Crawford and Cooke-Davies, 1999), and the ideas have been further developed in a Chapter in a forthcoming monograph (Cooke-Davies, 2000b).

More recently, a working party on “measuring project performance” took forward an understanding of different metrics that are appropriate for the measurement of project performance, both during the life cycle of a project, and after its completion. It concluded that the traditional three measures of time, cost and quality present an incomplete picture, that can be more comprehensively represented in terms of seven factors:-

- Commercial Success
- Schedule Success
- Quality Success
- Safety & Environmental Success
- Customer Success
- People Success, and
- Organisational Benefits.

The work has subsequently been picked up and taken further by the networks in Australia, from whom results are awaited. There is also the intention to incorporate these findings into future versions of the DCI, as will be discussed in Chapter 6.

5.2.3 Combining insights with fresh analysis.

A recent paper on knowledge management (Cooke-Davies, 2000a) illustrates the third way in which data from multiple sources can be combined. In this paper, the findings of the working party on learning lessons were combined with some data from relevant DCI questions, and a re-combination of questions from within the CPQ, to suggest both the extent to which knowledge management is currently employed, and its overall importance.

For example, the answers to two questions about finishing a project and starting a project were compared and contrasted (see Figure 24). It is interesting how poorly companies rate the quality of their post-project reviews, compared to their confidence in the project start-up process.

67. How does a project actually start?			
	High (4 or 5)	19 organisations	1 organisation
	Low (3 or less)	18 organisations	1 organisation
		Low (3 or less)	High (4 or 5)
		82. Do all projects hold post-project reviews to capture any relevant project information?	

Figure 24: Project start-up and Post Project Reviews

Two deductions were ventured from this:-

- Although three quarters of the 15 companies surveyed in 1996 had some form of post-project review process in place for capturing lessons learned about projects, only 2 companies out of 39 surveyed in 1999 believed that the process was effective. Could it be that companies "go through the motions"?
- Over half the organisations surveyed in 1999 rate their project start-up process highly, even though the same companies acknowledge that the "lessons learned" process is ineffective. It is as if they are saying to themselves, "We didn't learn from the last one, but we're setting it properly this time."

In a further section of the paper, 27 of the CPQ questions were found to be pertinent to five topics that conversations in workshops had suggested might be related to knowledge management – 3 of them doing duty in more than one category.

The topics with the number of relevant questions were as follows:-

- The nature and extent of project management training (5 questions)
- Specific knowledge management practices (10 questions)
- Questions about information management, metrics etc. (5 questions)
- Questions about the nature and extent of the project management community (6 questions)
- Questions about the project management culture (4 questions)

Both deployment and approach for these five topics was very low relative to other topics in the CPQ. Table 5 shows how the mean deployment scores for these five areas compare with the eleven main topics examined by the network.

Project Management Aspect	**Score**
Project Planning	60%
Defining and Executing Projects	60%
Managing by Projects	58%
Identifying and Managing Risk	58%
Defining Project "Anatomy"	57%
Human Factors	56%
Monitoring & Controlling Progress	56%
Estimating	54%
*Information**	53%
*Culture**	52%
*Training**	51%
Managing Quality	50%
*Community**	49%
Closing Projects	47%
Measuring Project Performance	46%
*Knowledge**	45%

Table 5: Knowledge and Community Practices.

The paper concluded that there is much room for improvement in these areas in project-based organisations.

5.3 The Corporate Practice Questionnaire

The Corporate Practice Questionnaire (CPQ) was the first instrument developed for use in this research programme (See appendix L-2). It's development through three stages has been described in Chapter 4 above, and a complete list of the questions are included at Appendix P-5. The purpose of the instrument is to provide organisations with a "ranging shot", allowing them to see how their practices compare with other companies that have provided data. This allows them to make decisions about the topics that they wish to see included in the continuous action research programme.

5.3.1 How organisations use the CPQ

This section does not contain a detailed and exhaustive analysis of the data because the subjective nature of the scoring makes the value of the data suspect in terms of deducing generalised conclusions about project management practices that are useful to all companies and in all circumstances. Organisations that have wrestled with providing an answer to each question based on the guidelines provided (see below) find great value in comparing their practices and scores (subjectively arrived at through internal dialogue) with other organisations with whom they have built up a relationship through the workshops, working parties, and informal contacts.

Each question in the CPQ is supplied to the network member with an explanation of the rationale, and some scoring guidelines. For example, the first topic of the CPQ explores the extent to which organisations integrate project working into the whole organisation, and the first section of the questionnaire explores the extent of project working throughout the organisation. The questions, rationale and scoring guidelines for this sub-topic are shown below

01. Integrating project working into the organisation.

a) Extent of project working

1 Does the organisation recognise projects as a valid way of working?

This question is probing the extent to which a project structure is employed by the organisation in executing its business. Some organisations do not employ any form of project working either through ignorance or through a preference for a departmental structure while others treat virtually all activities as projects.

Projects are not the preferred way of working. (0)

All mainstream activities are treated as projects. (3)

All activities are treated as projects (5)

A score of 0 may be given for an organisation that has projects but where they are set up in the face of strong management opposition or indifference. A score of 5 would only be given if all activities in all departments (e.g. Accounts and Sales) are automatically project oriented.

4 To what extent are project management practices brought to bear when implementing change programmes?

All our change programmes are run as totally separate entities from our project management activities. (0)

Some of our project management techniques are used in the management of change. (2)

We have a fully integrated approach to change management using the full power of project management where appropriate. (5)

It should be noted that this does not imply that mainstream project management is necessarily involved in managing change programmes.

5 How is the Project Office concept used to support change in the organisation?

A project office provides a centralised service for all elements of a project. It usually provides planning, monitoring and control functions as well as being the source of information about methodology, standards and best practice.

No use is made of a project office. (0)

There is an informal tracking of progress, costs and the perceived benefits. (3)

A formal project office is set up for all change programmes to provide accurate recording of the key indicators. (5).

7 How many levels of hierarchy are involved in financial, resourcing, and scheduling decisions?

Every decision that must be referred upwards inevitably leads to a delay. In any organisation a balance has to be struck between the delay incurred and the control to be exercised.

At least three levels are involved. (0)

The project manager has all the authority needed.(5)

12 Are there structured in-house learning opportunities for all staff giving them access to basic project In order to function effectively all staff in the organisation need to be aware of the basics of project management and the project approach applied in the organisation. There is no training available. (0) Good training is available for project staff. (2) Good structured and controlled training is available for all project staff and for those directly associated with projects at the time. (3) All staff are given project management training at an appropriate level as part of their normal personal development plan. (5)

Table 6: Questions on "Extent of Project Working".

Each organisation then decides how it can best obtain the data from the project management practitioners within the organisation, or in the part of the organisation that is being represented in the network. Answers are then provided to the research database, for subsequent analysis of both the words and the numbers.

The epistemic procedure is much more akin to Rawls' "pure" procedure, where the result of the score contains within itself the rating that members have agreed among themselves is an appropriate result, than it relates to an objective measure of "which practices produce the best result". Indeed, this question is hardly touched upon, since no tangible metrics for performance are included in the instrument – the nearest is the three questions on how the overall success of projects is judged by the organisation, the customers and the project team members.

More will be said about using the CPQ data in search of "objective" (positivist) insights later in this Chapter.

In this first section of the results, a set of extracts will be produced from a report produced in May 1999, showing how organisations can position themselves relative to other members of both their own network and other networks, in order to get some indications of how their practices differ from those of other organisations that they respect.

5.3.2 Illustrative results produced from the CPQ

The particular analysis that will be used for this illustration included data from the following companies:-

- The Automobile Association
- Balfour Beatty
- BBC Monitoring
- British Telecom
- Cable and Wireless Communications (from two separate divisions)
- Halifax plc
- Lloyds TSB
- Marconi Electronic Systems
- Matra Marconi Space UK
- Perkin-Elmer
- Post Office Consultants
- SmithKline Beecham

Comparative results were produced for each topic and sub-topic, for the network as a whole, and for sub-divisions within the network.

At an overview level, the range of scores was shown for all topics, both for "approach" and for "deployment".[1]

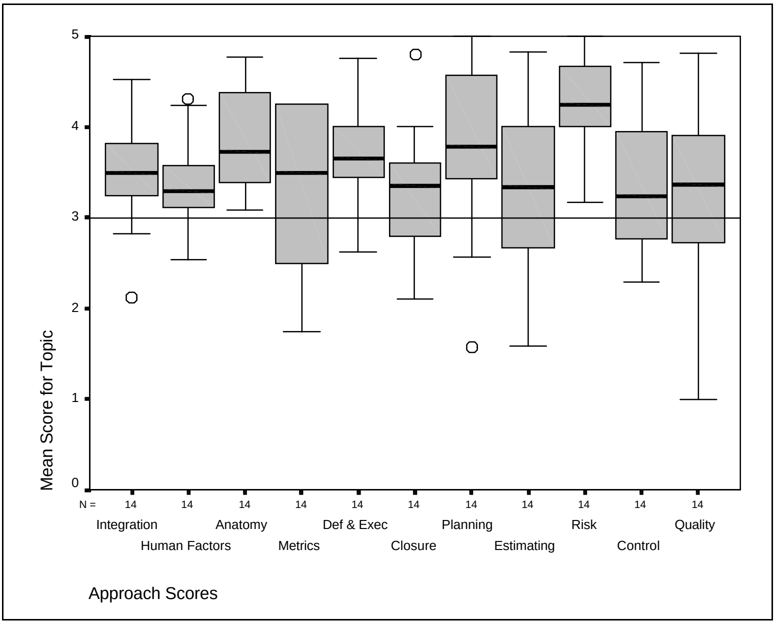

Figure 25: Range of approach scores.

An additional report was produced for each member of the network, indicating with a star on the boxplots how their own scores compared with those for the network as a whole. This allowed members to locate their scores into the appropriate quartile for each topic.

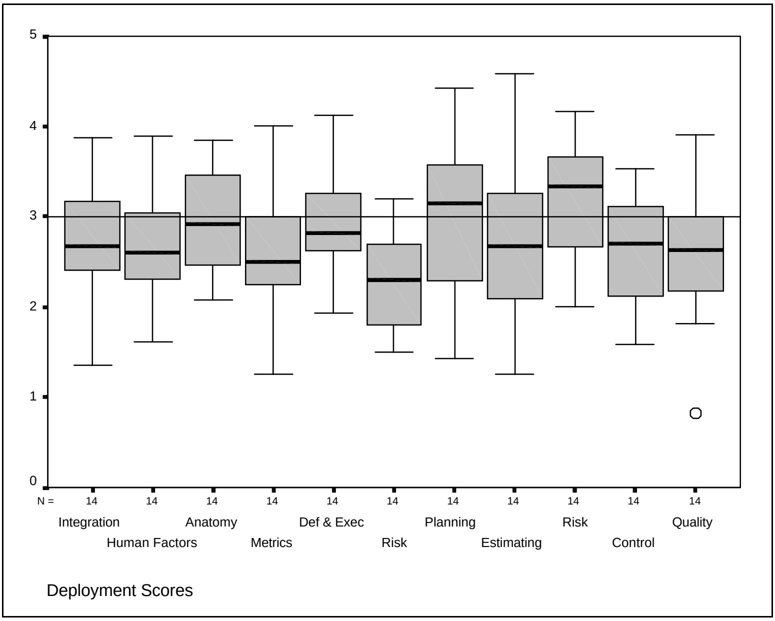

Figure 26: Range of deployment scores.

Comparison was made between organisations that carried out their projects for internal clients using their own resources (known as the "in-house" perspective) with others that provided products or services to external clients (suppliers) or that bought project services in from supplier companies (procurers) – see Figure 27. The fourth possible perspective (an organisation that undertakes projects for external clients using external resources) is that of "prime contractor".

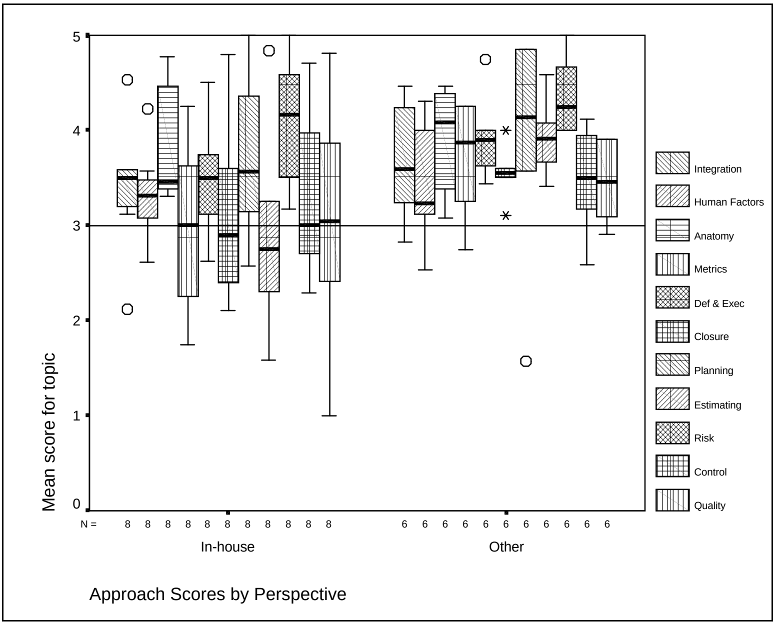

Figure 27: Range of approach scores by perspective.

Since this report contained data from members who had produced answers to the previous version of the CPQ report, it was also possible to show how scores had moved for the same companies, including only those questions that had been common to both versions of the CPQ. (See Figure 28).

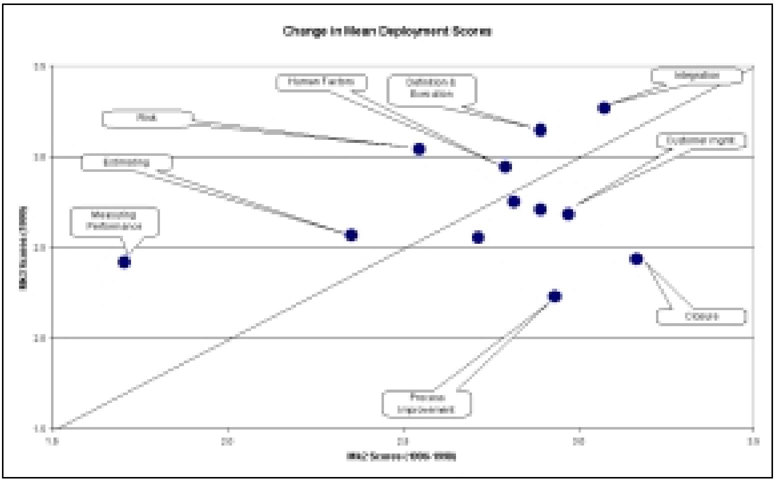

Figure 28: Comparison of CPQ deployment scores over time.

From these and similar charts, taken together with an analysis of the textual evidence, it was possible to draw some conclusions that applied to this selection of members, as follows:-

Project management communities believed that their organisations were generally dissatisfied with the results obtained by their projects, due to over-optimism at the outset, late completion, overspends, failure to deliver benefits and lower-than-expected return on profit.

Much excellent project management practice was incorporated into the approach of these same organisations, and in certain critical areas, such as risk management, it was improving. Project planning and risk management scored highly for both approach and deployment, and virtually all companies in the data set were adopting ways of integrating project working into the organisation and developing "muscle memory" through the use of standard corporate approaches or a corporate methodology.

Any delivery system, however, is only as good as its weakest point, and the report pointed to such weak points in general practice within the network. Deployment was generally less good than approach in all areas, but particularly so among the top-scoring companies for "monitoring and controlling progress" and for "closing projects". Among the majority of companies, "risk identification and management" revealed the largest gap between approach and deployment.

A theme that threaded its way through the individual topics was the challenge faced by even the best organisations in transferring lessons learned from one project to another. This was the worst scoring sub-topic in the report. The challenge showed up most acutely in "closing projects", a topic that was not only the lowest scoring one in the questionnaire, but was one that had become noticeably worse in the two years or so since the questionnaire had last been answered by the network.

The second-lowest scoring topic was project control. Costs were controlled better than schedule, with resources being controlled even less well. When the lack of control was considered together with the difficulties in learning lessons, the weakest point in the delivery systems began to reveal itself.

In-house project organisations who lacked both the disciplines of contracts (which procurers had) and the incentive of commercial survival (which suppliers have) scored less well than the others in four areas: "closing projects", "project planning", "monitoring and controlling progress" and "managing quality". (Extract from CPQ Report, 1999)

A more detailed comparison of both the scores for sub-topics, and the text answers that were provided as evidence for their scores by members, allowed certain patterns to be identified for the specific group of companies providing the data. The following example shows both the scores (Figure 29) and the comments[2] that were offered in connection with the answers to Topic 1, Integrating Project Working into the organisation.

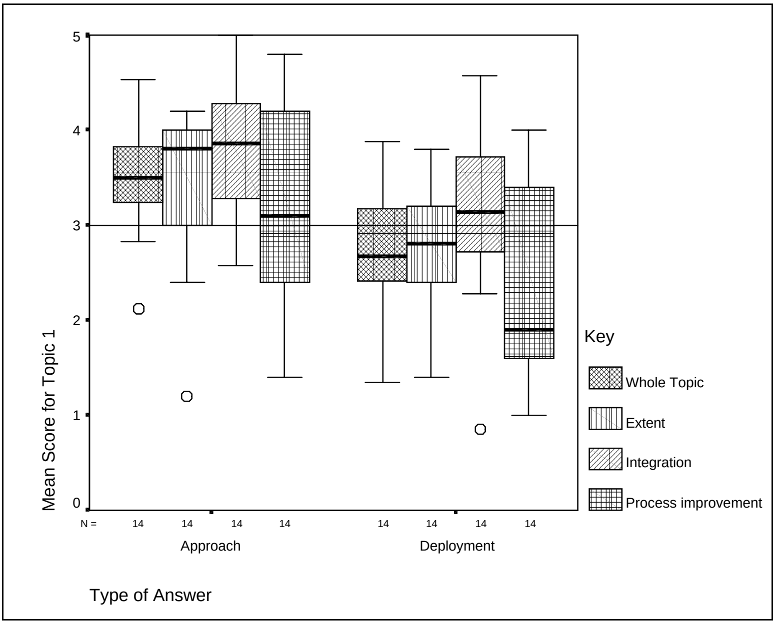

Figure 29: CPQ Scores for Topic 1: Integration

<u>Approach</u>

Extent of Project Working

In higher scoring companies project management training and support is available to all employees, and all managers undergo project management awareness training. All activities are regarded as projects, including all change management activities. Some organisations with extensive project working, however, do not manage organisational change using project management techniques. Higher scoring companies give project managers full authority once a project has been authorised.

Integration of Projects

Best practice is to regard projects as an essential part of the business with project managers having no other job functions. There is a link between authorised project budgets and schedules and assumptions integrated into the business plan. The financial programs of projects are integrated into long range capital planning cycles, and are not altered to suit annual budgeting. Program management is widely used, but portfolio management polarises members of the network between those where portfolio reviews are an integral part of business operations, and those where each project runs purely as a stand-alone entity. Higher scoring companies have a mechanism for integrating project estimates with the corporate budgets. ERPs such as SAP are beginning to appear.

Implementing Process Improvement

Scores are generally worse than in the previous issue of the Corporate Practice Report (1996 - 1997). There is a broad spectrum of practices with better organisations having budgets available to support process improvement and efficient process improvement processes linked to ISO registration. The use of a standard corporate methodology is still the most widely used mechanism to spread the application of best practice.

Deployment

Extent of Project Working

Best practice companies implement training throughout the project organisation and regard project management as a means of introducing change. Deployment often falls down, however, when only the project managers are seen to be those requiring training and it is their responsibility to add the project management discipline to their projects. One or two companies run change programmes completely independently of the project management community, and make no effort to employ the expertise of professional project managers. Higher scoring companies have regular reviews of all projects and feed data into the project office, whereas other companies use project offices only when a customer will pay for them, or if the project is large enough. Project managers in a few companies are granted explicit tolerances and all necessary authority to make decisions, whereas in many organisations key decisions are completely outside the control of the project team.

Integration of Projects

A broad spread of practices ranges from "ad hoccery" to a structured approach that integrates projects into strategy via program managers or project portfolios. Poor forecasting on projects can result in the business planning process ignoring project plans, particularly poor resources. Alignment appears to be simpler for suppliers, whose entire business consists of delivering customer projects. There is a wide divergence in the practice of applying portfolio management, several organisations comment on the recent introduction of program management and its partial implementation.

Implementing Process Improvement

The most commonly cited reasons for deployment falling short of approach are a lack of funding and a lack of support from the top of the organisation. Where best practice is spread, it is usually through the medium of knowledgeable individuals transferring from one project to another.

5.3.3 Individual company indications.

Reference has been made above to the ability of individual members of the network to compare their performance with that of others, and some examples will be included to illustrate this. The examples are all created using an Excel spreadsheet with macros[3], that enable a member company to examine the detailed numerical variations between their own score and those of their own or selected other networks on any topic, sub-topic or individual question

The first ability is to compare practices for the whole CPQ "at a glance" (Figure 30). These Kiviet diagrams show the high, low, median, 25th and 75th percentile scores, along with the actual scores for an individual company.

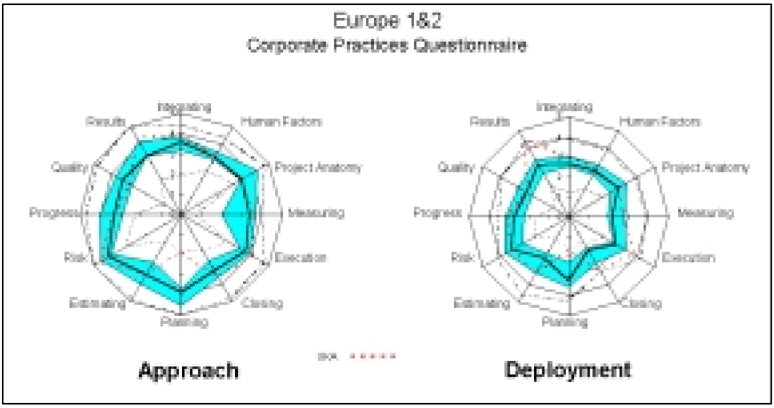

Figure 30: Individual Company CPQ Scores

Individual topics can then be explored in greater depth (Figure 31), in which the same six data points are displayed in the form of boxplots.

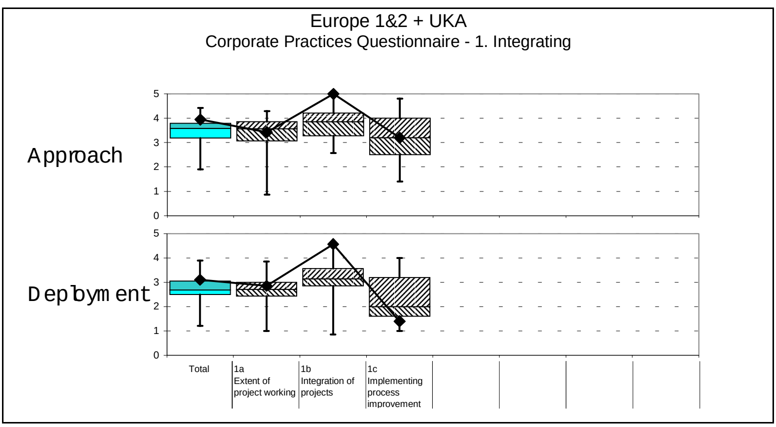

Figure 31: CPQ scores for topic 1

Performance can be compared not only with the same network, but also with others (Figure 32)

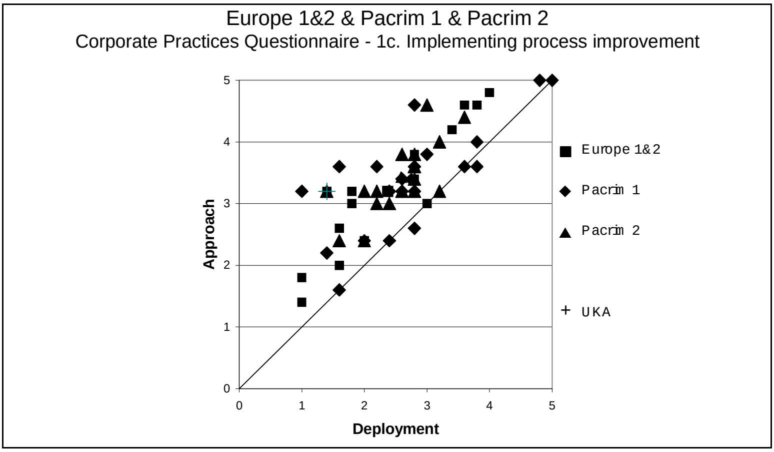

Figure 32: CPQ scores for topic 1a compared across three networks.

In order to review specific practices, the comparison can be made at even a detailed question-by-question level. (Figure 32 – The individual questions and scoring guidelines for this sub-topic are given in detail earlier in this Chapter.) On this chart, each bar shows the number of answers giving that score for the particular question that is denoted, with the company's own score indicated with a black square (for deployment) and diamond (for approach).

This self-scoring guide provides a "relative" position for member organisations to decide what topics they believe would best be explored. The flow during a typical year is shown in Chapter 4 at Figure 17.

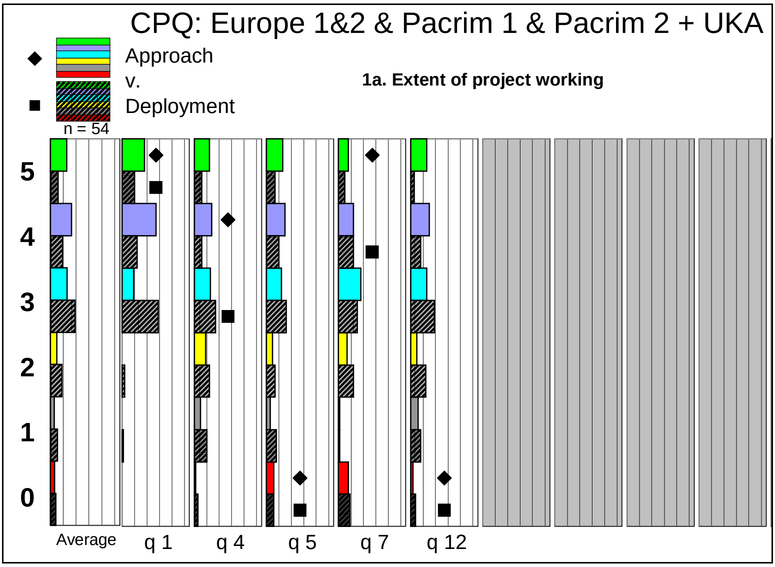

Figure 33: CPQ Scores for individual questions.

The important use of the analysis in the overall method is to allow the member organisation to make an informed decision of the topics that it wishes to pursue during the coming year. It also allows the research facilitators to identify organisations that might be suitable to invite to make "case study" presentations to the chosen workshops.

5.4 The data collection instrument (DCI)

Two of the research questions that this thesis is seeking to answer (Questions 4 and 5, see Chapter 4 above) are concerned with the evidence for particular practices having a recognisable effect on project performance. These are the questions with which this section of the thesis is concerned.

The Data Collection Instrument, referred to in section 3 of this Chapter and in Chapter 4, is the instrument that member organisations use to provide data for analysis. The data is a mixture of "hard" performance data (such as planned and actual project duration, planned and actual project cost), factual reporting of project characteristics and strategies that were adopted, and assessments of "soft" project management practices.

The question being asked in this analysis is, "What project management practices, if any, can be shown to have a measurable and predictable impact on project performance across a wide range of types of projects?" What is being sought is statistically significant relationships between project management practices and project performance measures. The structure of the analysis was described above in Chapter 4 (see Figure 19).

5.4.1 Project type and industry environment.

To answer the research question, it is necessary to show that the nature of the projects and the organisations undertaking them was sufficiently varied for any conclusions that are drawn from the data to be considered valid across a wide range of project types.

The data set that was analysed consisted of 136 projects provided by 23 companies. A complete list is attached at Appendix P-7. The projects ranged up to over £300 million cost and 10 years duration, with an average of £16 million and 2 years, and a median of £2 million and 18 months.

Companies were classified as belonging to one of four industry types:-

- Financial Services – 5 companies involved in retail or wholesale banking, insurance or savings and loan.
- EPCM (Engineering, procurement and construction management) – 7 companies largely undertaking construction or civil engineering projects. These companies include the divisions of large companies (such as utilities) that procure capital engineering projects, as well as suppliers.
- Telecoms – 4 companies involved with the provision of retail and wholesale telephone services for voice and data, including public national and international network services, and the manufacture, sales and installation of telephone equipment.
- Misc – 7 companies that would be readily identified if their particular industry were to be named.

There was no significant pattern of project size by industry – all four industries provided data on projects up to £100 million, and three of them (minus Telecoms) on projects over £100 million.

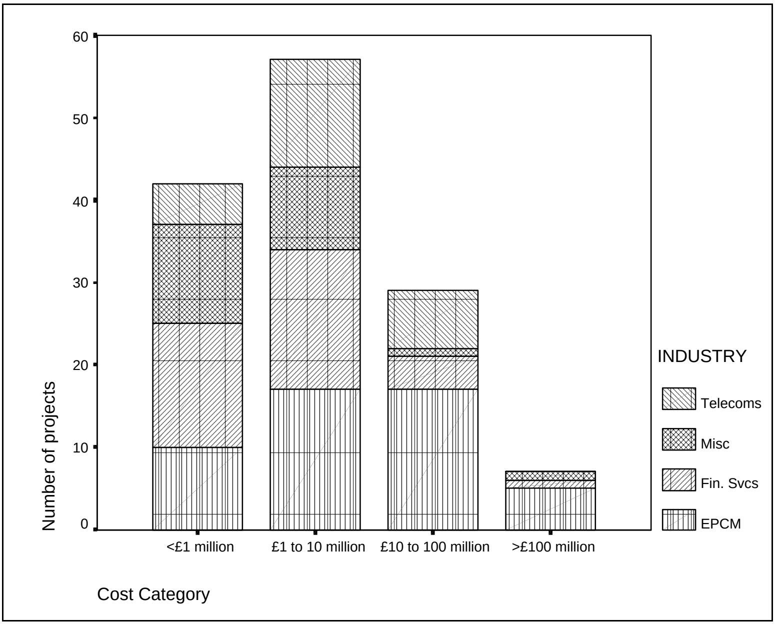

Figure 34: Project cost categories across industries.

The projects were classified according to the nature of the individual projects (the original data contains the actual name of the project, along with a description of its goals and the major deliverables – these have been removed from the table analysed in this thesis, to protect sensitive information.) The project classifications were as follows:-

- Construction – 29 projects to design and build new physical assets such as plant, highways, buildings or water mains. No distinction is made between construction and civil engineering and any accompanying mechanical and electrical engineering works.
- Refurbishment – 14 projects to refurbish existing buildings and/or other facilities. Some of these were for human habitation, and some were mechanical installations.
- Hard systems – 25 projects consisting of hardware and the associated software to operate it. Projects include infrastructure IT projects, electronic control systems and telephone systems.

- Soft systems – 25 projects consisting of changed business processes, usually supported by new or modified software.
- New products – 19 projects consisting of the specification, design and manufacture of new products. They include electronic systems, aerospace products, telephone products and financial services products.
- Other – 24 mixed projects that range from internal training and culture change projects, to regulatory approval.

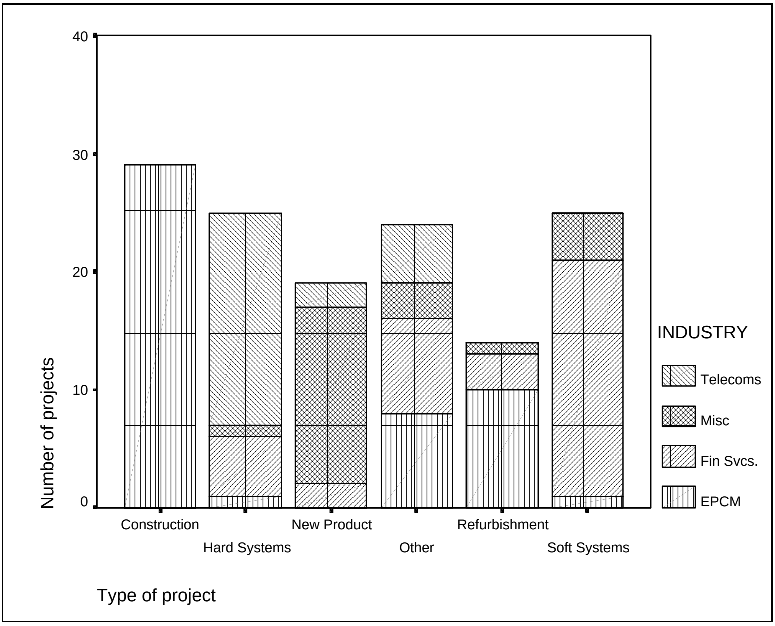

Figure 35: Types of project undertaken by industry.

As figure 35 shows, not all projects were of the same type as the industry of the company undertaking them, with the exception of construction projects, undertaken exclusively by EPCM organisations. The companies that carried out the projects provided the data, and detailed personal interviews were carried out with representatives of the companies to ensure that the data was accurate to their satisfaction. In one or two instances the data has been scaled down to disguise commercially sensitive details of high-profile projects. In the majority of the cases, however, actual project data has been used. The factual data on project characteristics and strategies, and the "soft" data on project management practices were likewise provided by the companies themselves, and audited by themselves to their own satisfaction. In several instances, the researcher presented summary findings from the data, and actual data from the organisation, to the project management communities of the organisation that provided the data, and this acted as a form of validation of the data. More will be said about validation later.

Not all the projects were completed, since the DCI is an instrument that offers benefits to individual project managers, who are encouraged to use it several times during the life of a project. One of the concepts introduced into the DCI in all Mk2 versions is the concept of the "most advanced key project event" (MAKPE). There are a total of 19 of these (see section 3 above, and appendix P-7), and they can be fitted into any life-cycle model. For the purposes of describing the profile of projects in the data set being analysed here, the they can be mapped onto the five phases of APM's most recent edition of the Body of Knowledge (Dixon, 2000)as follows:-

Phase 1: Opportunity Identification – up to MAKPE 6 (Feasibility Study/Preferred Option Selected)

Phase 2: Design and Development – up to MAKPE 12 (Place Contracts)

Phase 3: Implementation – up to MAKPE 15 (Inspect and Test Project Deliverables)

Phase 4: Hand-over – up to MAKPE 17 (Client Agrees to Close the Project)

Phase 5: Post-project Appraisal – up to MAKPE 19 (Project Closed)

The actual number of projects in each of these life-cycle stages is shown in Figure 36.

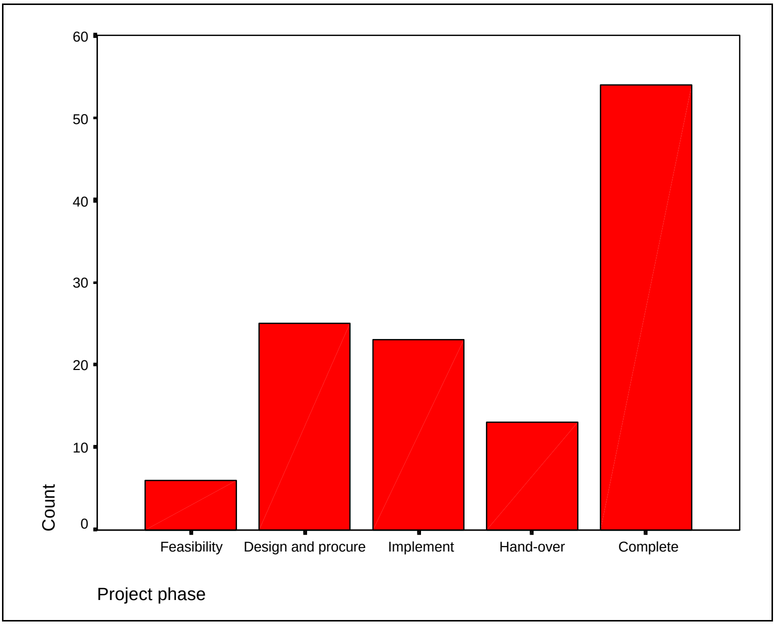

Figure 36: Number of projects in each life cycle phase.

For each data submission, irrespective of whether the project has been completed or not, a record was provided of the forecast cost at completion and the forecast duration of the project (along with the planned cost and planned completion). The forecast cost and duration have been used throughout this analysis as measures of the project cost and duration.

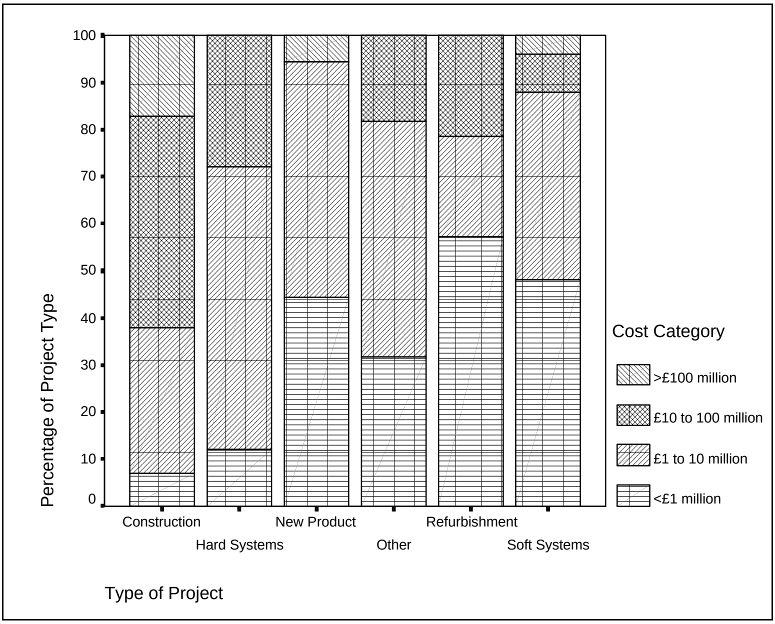

Figure 37: Percentage of cost categories for each type of project.

Figure 37 shows the percentage of projects in different cost bands for each of the different types of project. The very large projects in the sample (those costing over £100 million) were spread across three types – construction, new products and soft systems; projects in the category of £10 million to £100 million occurred in all types except new product development; and projects costing up to £10 million were to be found in all six types of project.

Just as the cost bands are spread across the project types, so are the project durations, as Figure 38 shows.

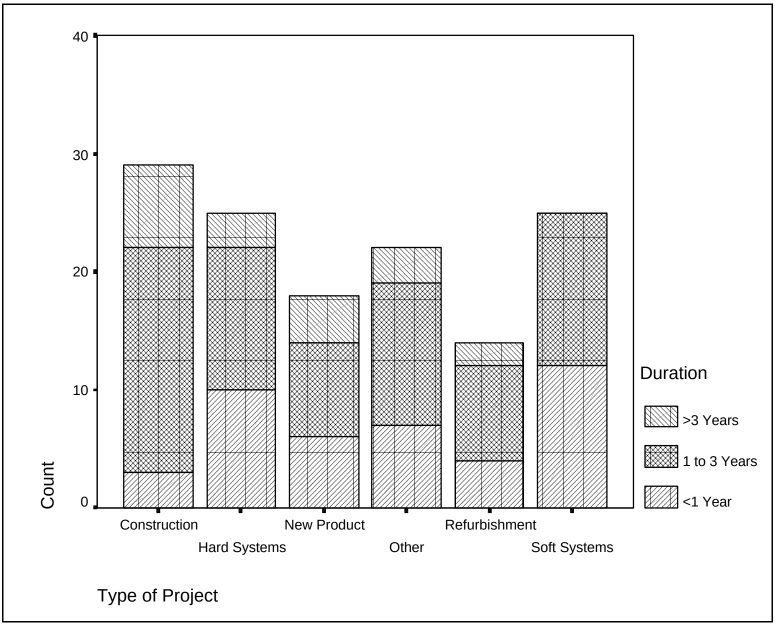

Figure 38: Duration of projects within each type.

Not surprisingly, there is a significant relationship between the cost of a project and its duration in weeks (P=0.0003), as can be seen in figure 39, although the root mean square is only 0.2411, which can be interpreted as suggesting that only some 24% of the variation in project cost is due to project duration.

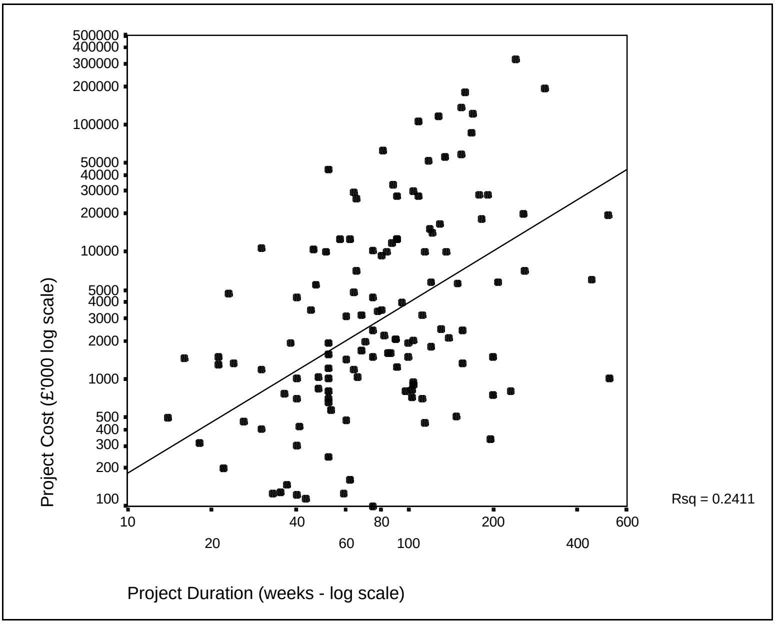

Figure 39: Project cost (£'000) and project duration (weeks)

5.4.2 Project results

A second prerequisite to the research question is to establish performance measures that can be externally verified, and that are recognised as valid for projects of all types.

Unlike the CPQ (See section 1 of this Chapter), which includes "soft" measures assessing perceptions of project success, the data collected using the DCI concentrates on more tangible measures – principally cost, time and scope, the three "classic" measures of the project manager's "iron triangle". The measures of performance that have been included in the analysis are as follows:-

1. Cost predictability: the ratio of forecast or actual cost to the planned cost that was used as the basis of justifying the project. In the case of contracts between suppliers and procurers, the planned cost includes the additional sums included for additional scope of work and agreed between the supplier and the client. A ratio of greater than 1 implies over-budget performance.

2. Time predictability: the ratio of forecast or actual duration in weeks to the planned duration that was incorporated in the financial approval used for cost predictability. Additional time for additional work is included, where this is covered by the scope changes referred to in the cost predictability measure. A ratio of greater than 1 implies that the project is late against planned schedule.
3. Cost & time predictability: the product of cost predictability and time predictability. This measure provides a surrogate for the "optimisation" of demands between budgetary constraints and schedule requirements, and is the inverse of "earned value" in earned value analysis.
4. Scope predictability (available in only 67 of the 136 projects): an assessment of the percentage of the actual product or service (measured by the quantity and quality of deliverables) that was delivered. If the scope was adjusted in the case of 1 and 2, then the baseline for the measure relates to the scope as modified by the agreed amount included in the planned cost and time. A ratio of greater than 1 implies that more of the product or service was delivered than had been planned.
5. Overall predictability$_1$: A crude surrogate measure for "what an organisation gets" compared to "what was expected" expressed as a ratio. The number is obtained by dividing scope predictability by cost & time predictability. A ratio of greater than 1 implies that the project delivered better results than was expected.
6. Overall predictability$_2$: An even cruder surrogate than overall predictability$_1$. Since only 67 projects allow the calculation of overall predictability$_1$, this measure takes the best available measure. Where a measure is available for overall predictability$_1$, this is used: where none is available, the inverse of cost & time predictability is used as a surrogate.
7. Performance Band$_1$: Overall predictability$_2$ arranged into three bands of performance – better, worse or as planned. The central band is taken for projects whose overall predictability lies between 90% and 110% of plan.
8. Performance Band$_2$: Overall predictability$_2$ arranged into five bands of performance – much better, better, much worse, worse or

as planned. The bands (from worst to best) are <80%, 80% to 95%, 95% to 105%, 105% to 120% and >120%..

These can be considered as three independent measures (1, 2 and 4), with five further measures derived from these primary ratios.

Firstly, a word about the fact that not all the projects in the data set had been completed at the time of submitting data. This might cause some concern if it could be shown that variances from plan increased, the further the project advanced through the life cycle. In the event, this isn't the case. There is no significant correlation between the "MAKPE" of a project, and the measures of predictability (see Table 7). It is thus possible to draw conclusions from the set of data as a whole.

Correlations		Cost Predictability	Time Predictability	Scope Predictability	MAKPE
Cost Predictability	Pearson Correlation	1	0.296023	0.233916	0.004522
	Sig. (2-tailed)	.	0.000597	0.056758	0.960413
	N	131	131	67	123
Time Predictability	Pearson Correlation	0.296023	1	-0.025760	0.021112
	Sig. (2-tailed)	0.000597	.	0.836069	0.815226
	N	131	133	67	125
Scope Predictability	Pearson Correlation	0.233916	-0.025760	1	-0.112390
	Sig. (2-tailed)	0.056758	0.836069	.	0.396717
	N	67	67	67	59
MAKPE	Pearson Correlation	0.004522	0.021112	-0.112390	1
	Sig. (2-tailed)	0.960413	0.815226	0.396717	.
	N	123	125	59	128

Table 7: Correlations between predictors and "MAKPE".

There is a significant correlation between time predictability and cost predictability (P=0.0005), but there are big differences for individual projects, as can be seen in figure 40.

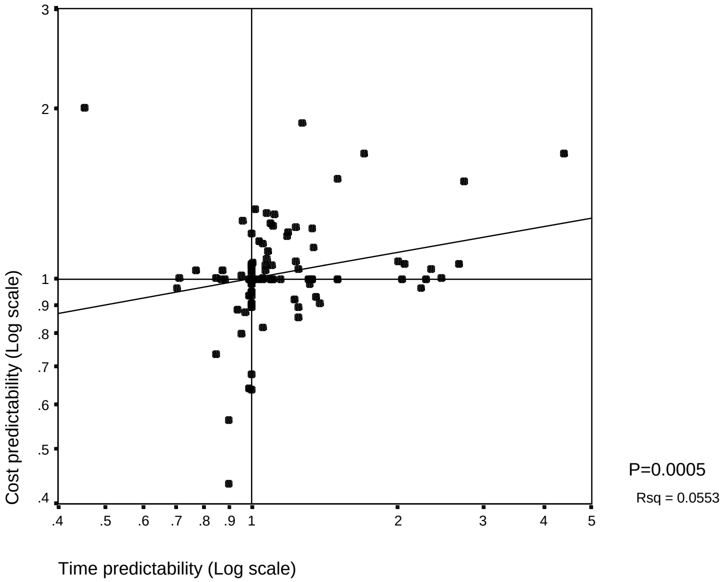

Figure 40: Relationship between time and cost predictability.

Rather more of the variation in cost from plan is accounted for by variations in scope: the root mean square is 0.1566 (Figure 41), even though the significance of the correlation is somewhat lower at 0.0010.

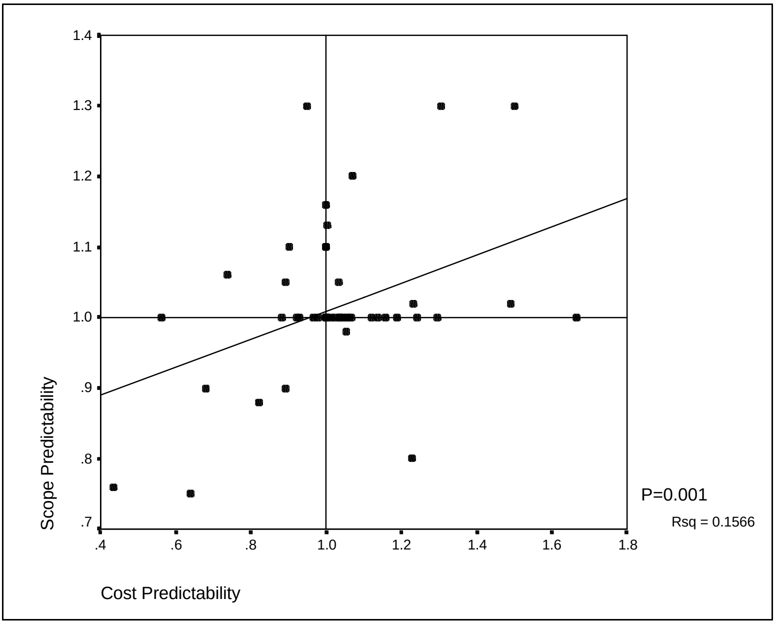

Figure 41: Relationship between cost and scope predictability.

Note that the scatter plot in figure 41 contains only 66 data points, rather than the 67 that are contained in the data set. The case that has been omitted (Project 32) was an extreme outlier for scope predictability, owing to unique circumstances known to the researcher. In this particular project the supplier agreed to provide a product that exceeded the specified scope by virtually 100%, without passing on the costs to the procurer (who provided the data), in order to provide themselves with experience of using a new technology. Admittedly, all projects are unique, but in this case, the costs reflected in the project data (as paid by the procurer) provided no reflection of the work carried out (intentionally) by the supplier. It is thus legitimate to exclude the data point – indeed, to leave it in would distort the data more than to exclude it.

There is no significant relationship between scope predictability and time predictability (P=0.935). Since cost control is a visible and pervasive aspect of organisational life, and projects play their part (as has been seen), the suggestion is that controlling time on projects can have a small impact on costs, and controlling scope can have a somewhat larger one.

Before examining the impact of specific project management practices, the relationship was investigated between project performance and the industry, type of project, and scale of project (cost and duration). Investigations revealed no significant correlation between any of the performance measures and industry or type of project, other than a higher median scope predictability for "suppliers" (P=0.0013), which sounds reasonable, but is unreliable because only two projects from suppliers contained scope predictability data.

Correlations		Cost Predictability	Time Predictability	Scope Predictability
Duration (weeks)	Pearson Correlation	0.1713	0.2640	0.2868
	Sig. (2-tailed)	0.0513	0.0022	0.0196
	N	130	132	66

Table 8: Correlations between predictors and project duration.

Examination of the scale of the project, however, reveals more significant correlations. Both time predictability (P=0.0022) and, to a lesser extent, scope predictability (P=0.0196) show a correlation to the duration of the project (see table 8), suggesting that the longer the project, the more difficult it is to control both schedule and scope. I suppose that the project managers of the new British Library project would be willing to attest to the validity of this finding!!

5.4.3 Strategic decisions

An assumption that can be tested as a part of this overall research question is the extent to which project management practices are determined by the strategies adopted towards the project and the procurement contracts. The chosen project strategy should, theoretically, drive the management practices followed on a specific project. To investigate whether this appears to be the case in practice, participants were requested to identify which of the following drivers governed the project strategy that was adopted:-

- Time
- Cost
- Quality
- Relationships
- Process
- Contingency (i.e. the strategy was dictated by specific circumstances not covered by any of the previous five).

As an additional question, the strategy was identified as one of:-

- The kind of strategy that is usually adopted.
- The kind of strategy with which the organisation is familiar, but which is not the usual strategy, or
- A strategy that is novel to the organisation.

In addition, the strategy pursued when placing contracts to procure major elements of the project was identified as being:-

- Fixed price
- Target price
- Flexible price (i.e. time and materials, or some variant of it)
- A hybrid strategy (combining elements of the first three)
- A partnering strategy (based on partnering arrangements with suppliers, that specify overall terms and conditions for these and other projects)
- An alliance strategy (based on pain- and gain-sharing arrangements that treat suppliers as equity-holding partners in the project).

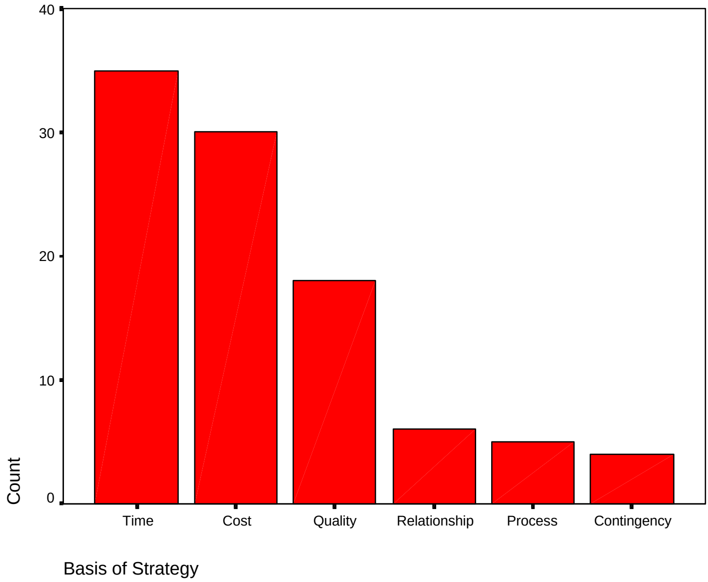

Figure 42: Types of project strategy.

Figure 42 shows the number of projects adopting each type of project strategy. The most common driver of project strategy is time, followed closely by cost. These two account for the strategies of nearly two thirds of all the projects answering these questions. Only 10.1% of all strategies are ones that have not been used before, with 59.6% being the "usual" strategy – suggesting a conservatism about the choice of project strategy.

A similar conservatism appears to influence the choice of contract strategy, with 53% of all projects that answered the question employing a "fixed price" strategy. A further 23% use a "flexible price" contract strategy.

There is no evidence that any of these strategies is generally successful in achieving its objectives. There are no statistically significant correlations between any of the three variables for project strategy and any of the seven measures of project performance. It might have been expected that a time-based strategy would produce better time predictability, or that cost predictability might be influenced by either a cost-based strategy, or by a fixed price contract strategy. That doesn't appear to be the case. Even familiarity with the strategy appears to offer no reliable path towards any measure of predictability. It would appear that the choice of a strategy based on a high-level desire to control a specific aspect of project performance (such as project duration) provides no confidence that it will have the desired effect.

5.4.4 Project management practices.

So far, it has been possible to draw three general conclusions that relate to a wide variety of projects: firstly, that the longer the project lasts, the more difficult it is to control; secondly, that cost control depends to a small extent on time control, but to a greater extent on scope control; and thirdly, that choosing a project or contract strategy at a high-level of generalization provides no guarantees of achieving the desired performance.

It is now time to examine what might be going on behind these three broad conclusions – to see what project management practices, if any, can be shown to influence project performance.

The "soft" data on project management practices was answered by providing answers to 81 questions (Listed at Appendix P-6) in the form of an assessment of the adequacy of the practice, as carried out, for the complete conduct of the project. Participating organisations validated this data, along with the "hard" data described above, by approving a report listing each of the projects that they had submitted, along with the data contained on it in the database. Where organisations were unhappy that the data reflected the situation as they understood it, they amended it as appropriate. Very few amendments were necessary.

Project management practices employed on the specific project were investigated by means of 82 questions (see Appendix P-5). These were supplemented by gathering other information about the strategies adopted, and the way the project was organized. The scale used to score these project management practices was a four-point scale ranging from Not at all adequate (1), through Partially adequate (2), and Largely adequate (3) to Fully adequate (4). Representatives from each organisation were trained on the meaning of these terms, and pilot project data was obtained by the researcher working with individual project managers. Strenuous effort was made to ensure a uniformity of understanding of the scoring scale, and of the precise meaning of each question.

Where the question referred to a “product” (i.e. a physical or logical entity that was produced for the purposes of managing the project), then this was the only scale used. Where the question referred to a “process”, however, an additional scale was used – that of the “maturity” of the process. Here the scale needs a little more explanation. A six-point scale was used:-

Not at All	The process does not exist. (0)
Committed	There is organisational commitment that a process should be used. (1)
Active	The process is being used on this project at the moment. (2)
Performing	The process is being used on this project at the moment by those fully trained in its use. (3)
Measuring	The appropriate use of the process on this project is being measured, using a formal standard. (4)
Verifying	The appropriate use of the process on this project is being measured, using a formal standard, the measurement is verified using a formal audit process and the process is reviewed. (5)

In addition to scores for individual questions, composite scores were calculated as the average for the following groups of questions:-

1. Planning
    - Time planning
    - Cost planning
    - Resource planning
    - Quality planning
2. Control
    - Time control
    - Cost control
    - Resource control

  - Quality control
  - Change control
3. Human Resources
   - Teamwork
   - Corporate culture
   - Competencies
   - Roles and Responsibilities
   - Client Management
4. Requirements management
5. Risk Management
6. Communications

The strategy for analysing those practices that might have a significant influence on some measure of project performance has been two-fold. Firstly, a CHAID (Chi-squared Automatic Interaction Detector) algorithm was employed to segment the whole data set according to the most significant relationships that can be used as predictors of each of the performance measures. Secondly, a bivariate correlation analysis was carried out, comparing each of the variables individually with each of the performance measures. When significant relationships were identified, the relationship between the project management practice and the performance measure that it correlates to was expressed graphically using either a scatter plot or a boxplot, depending on the nature of the variable.

CHAID Analysis

Figure 41 shows the CHAID analysis for practices influencing time predictability. The most significant relationship (P=0.0019) is the answer to question P2, "Is there company-wide education on risk concepts?". The figure shows that a total of 13 projects gave an answer of "fully adequate" (which equates to a score of 4), and averaged time predictability of 93.7% (6.3% early against plan) compared to the mean for the whole data set of 12.7% late. At the other end of the spectrum, the 16 projects that scored "not at all adequate" were, on average, 41.2% late. These two populations were too small to subdivide further according to the rules that were used for this analysis (each parent category should be no less than 20 projects, and each child category no fewer than 10 projects).

The exact rules used are a matter of judgement. If the categories are made large (say 100 for a parent, and 50 for a child), the model is likely to be very robust for predictive purposes, but will require a large sample to obtain significant relationships. If, on the other hand, the categories are made too small (say 10 for a parent and 1 for a child), there is likely to be a highly accurate description of the relationships within the current dataset, but little chance of the results being replicated in the case of a similar number of different projects. The actual rules adopted were 20 and 10 if possible, reducing to 15 and 5 if no significant relationships emerged in the first instance.

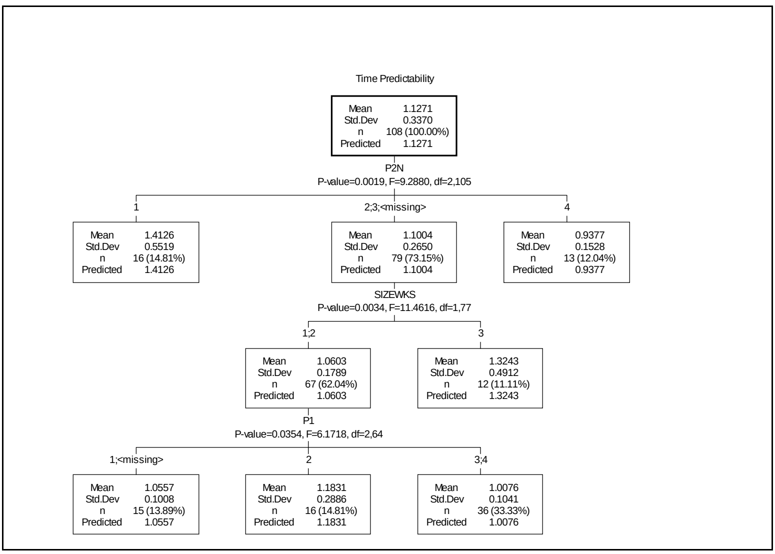

Figure 43: CHAID analysis, showing practices influencing time predictability.

The central group at the first level in figure 43 contain 79 projects that either scored 2 or 3 (partly or largely adequate) to question P2, or else did not answer the question at all. These had a mean time predictability of 10% late. This group next divided on a relationship already identified – the project duration. The twelve projects lasting longer than 3 years averaged 32.4% late, while the 67 projects that lasted less than 3 years averaged 6% late. The significance of this relationship was P=0.0034.

Finally, the population of 67 shorter projects was further subdivided according to the answers given to question P1, “Are there check lists of risks appropriate to the project?” The significance of this correlation is lower (P=0.0354), and this time the better time predictability was achieved by those 36 projects that scored 3 or 4 (largely or fully adequate) to achieve a score for time predictability of 100.76%, less than 1% late.

Unlike time predictability, for which nine project management practices showed significant correlations, cost predictability correlated to only two, “Have changes to scope been allowed only through scope change control process?” and “Has a system been used to provide the right level of information at the right level of authority?”. In figure 44, the most significant correlation was that involving the maturity of the scope change control process, in which the 81 projects scoring “Performing” or higher (but also including those not providing an answer to this question) averaged 1.4% cost escalation, compared to the average of all projects of 3.0%. Those 21 projects within this population that answered “fully adequate” to question 17 about providing the right level of information at the right level of authority improved this further to an average of 4.5% better than budget.

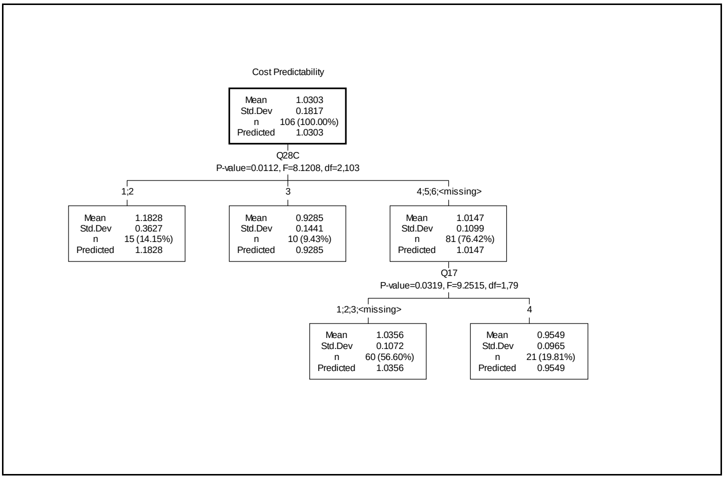

Figure 44: Practices correlating to cost predictability

Chaid analysis against the other performance variables failed to identify any relationships with a significance of greater than 0.01.

Bivariate Correlations

A second search for significant correlations between project management practices and project results was conducted using bivariate correlations. The Person correlation coefficient was identified for each variable compared to each measure of project performance, and the significance of the relationship established using a paired T-Test. The results identified a total of 21 correlations (see also Appendix.L-3)

		N	Correlation	Sig.
Pair 1	Time Predictability & P2N	100	-0.3136	0.0015
Pair 2	Cost and Time Predictability & P2N	98	-0.3462	0.0005
Pair 3	Time Predictability & Q2M	100	-0.3279	0.0009
Pair 4	Cost and Time Predictability & Q2M	98	-0.2825	0.0048
Pair 5	Time Predictability & Q5	100	-0.3128	0.0015
Pair 6	Time Predictability & Q6	100	-0.3524	0.0003
Pair 7	Cost and Time Predictability & Q6	98	-0.3026	0.0025
Pair 8	Time Predictability & Q7	100	-0.3626	0.0002
Pair 9	Cost and Time Predictability & Q7	98	-0.2976	0.0029
Pair 10	Time Predictability & Q12M	100	-0.2684	0.0069
Pair 11	Q16M & Scope Predictability	34	-0.5815	0.0003
Pair 12	Time Predictability & Q31M	100	-0.2807	0.0047
Pair 13	Cost and Time Predictability & Q31M	98	-0.2551	0.0112
Pair 14	Q65 & Scope Predictability	34	-0.4849	0.0037
Pair 15	Time Predictability & Q66	100	-0.3074	0.0019
Pair 16	Time Predictability & Q2C	100	-0.2875	0.0037
Pair 17	Time Predictability & Q3C	100	-0.2731	0.0060
Pair 18	Q16C & Scope Predictability	34	-0.5120	0.0020
Pair 19	Cost Predictability & Q28C	98	-0.2735	0.0064
Pair 20	Cost Predictability & Q29C	98	-0.2609	0.0095
Pair 21	Overall Predictability (1) & Q47C	34	-0.4635	0.0058

Table 9: Significant correlations between practices and performance.

This suggests that within this set of data, there are some specific project management practices that influence time predictability (P2N, 2M, 2C, 3C, 5, 6, 7, 12M, 31M and 66). The suffix M (or N in the case of the 5 "P" – for pre-project – questions) denotes the "adequacy" answer, where the suffix C denotes the maturity score. In the case of questions about "products", there is no suffix, since only the "adequacy" was recorded. These questions that influence correlate significantly to time predictability are:-

P2 Is there company-wide education on risk concepts? (Adequacy)

2 Is there a formal process for identifying and quantifying risks? (Adequacy and maturity)

3 Is there a process for selecting key risks based on probability and impact? (Maturity)

5 Have all risks that are to be managed had owners assigned?

6 Is there a visible risk register showing the impact & probability of each risk, and other information?

7 Is the risk management plan up to date?

12 Is information about risks communicated to the project team throughout the life of the project? (Adequacy)

31 Have baselines been well maintained and effective change management processes operated? (Adequacy)

66 Is there a document that shows which organisational unit is responsible for which work items?

The nature of these relationships can be illustrated graphically, as is shown in Figure 45, by the normal boxplot comparison of answers to the specific question (in this case P2) with the range of values for time predictability. The significance is 0.001. On this, and the boxplots in figures 22 and 23, a hollow circle represents an “outlier” (a distance of more than 1½ box widths outside the box) while an asterisk represents an “extreme” (a distance of more than 3 box widths outside the box).

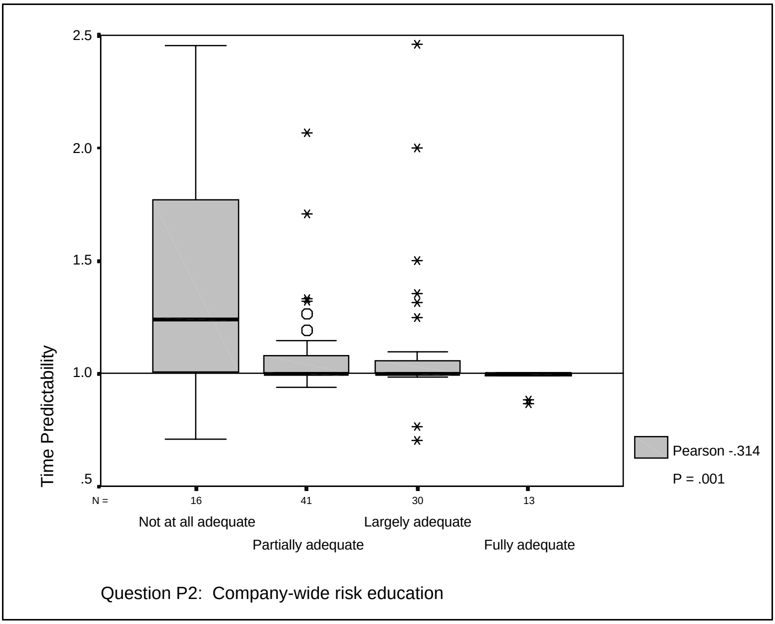

Figure 45: Influence of company-wide risk education on time predictability.

The corresponding questions that correlate to cost predictability are 28C and 29C

Q28 Have changes to scope been allowed only through scope change control process? (Maturity)

Q29 Has the integrity of the performance measurement baseline been maintained? (Maturity)

There are two difficulties with the practices correlating to scope predictability. Firstly, the number of data points (34) is small relative to the variations in scope recorded; and secondly, the Chaid analysis produced no relationships at 99% confidence (i.e. P of 0.01 or lower). For these reasons, no conclusions are drawn about practices that correlate to scope predictability.

Further investigation of the correlations

The significant correlations that have been identified above provide a good description of project management practices that were shown to have a significant effect on the projects in the data set. But how generally can these conclusions be applied? Will it always be true to say that having good company-wide education on risk management will increase an organisation's ability to predict the duration of varied kinds of projects?

To answer these questions, further investigation was required into the nature of the correlations within the dataset. This was carried out in two stages. Firstly, taking each of the variables that had been identified as significant using Pearson's Coefficient, a one-way analysis of variance was carried out, and significance tested once more. The results are shown in Appendix P-8, and confirm that for the following practices, the significance is still below 0.01, giving a confidence level of greater than 99%.

TIME

P2 Is there company-wide education on risk concepts? (Adequacy)

6 Is there a visible risk register showing the impact & probability of each risk, and other information?

7 Is the risk management plan up to date?

COST

Q28 Have changes to scope been allowed only through scope change control process? (Maturity)

The significance of the project duration in determining time variance was also confirmed at a confidence level of more than 99.8% (P=0.0016)

This correlation was illustrated graphically, by producing error bars of the range of values for the mean of the dependent variable (time- or cost-predictability) that could be expected with a 95% confidence level for each value of the answer given to the question. Such a chart is shown as Figure 46.

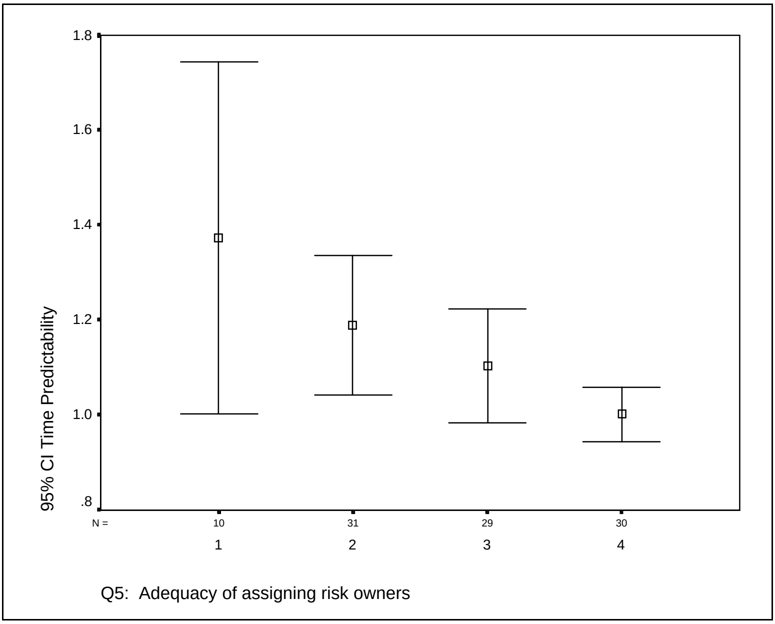

Figure 46: Effect of assigning risk owners on time predictability

For the following practices, the significance was above 0.01, but below 0.05, giving a confidence level of greater than 95%.

TIME

2 Is there a formal process for identifying and quantifying risks? (Adequacy and maturity)

5 Have all risks that are to be managed had owners assigned?

12 Is information about risks communicated to the project team throughout the life of the project? (Adequacy)

31 Have baselines been well maintained and effective change management processes operated? (Adequacy)

66 Is there a document that shows which organisational unit is responsible for which work items?

Only two practices failed to show significance at the 95% level or better:-

Q3 Is there a process for selecting key risks based on probability and impact? (Maturity) and

Q29 Has the integrity of the performance measurement baseline been maintained? (Maturity)

The assumption behind the one-way ANOVA test is that the distribution of values for each variable is normal, and this is not necessarily the case in the answers to some of these questions. To allow for this, a second test was carried out – the Kruskal-Wallis test – which is a non-parametric alternative to the one-way ANOVA. The results of this test are also included in the table in Appendix P-8. They showed that questions could be raised about how much confidence can be placed in the conclusions concerning three of the variables – Q2, Q3, and Q12. On the other hand, they indicated a confidence level of greater than 99% for questions 5 and 31.

5.4.5 Conclusions about effective practices

The question being asked in this analysis was, "What project management practices, if any, can be shown to have a measurable and predictable impact on project performance across a wide range of types of projects?"

A number of conclusions can be reached in answer to this question.

- Although there is a loose but significant relationship between time predictability and cost predictability, and a somewhat stronger one between scope predictability and time predictability, the traditional project manager's iron triangle of time, cost and scope are each influenced by different project management practices.
- Project management practices do not appear to have different effects when employed on different types of projects, in different industries or across the varying perspectives of in-house, supplier, procurer or prime contractor.
- Projects that cost more than £100 million do not seem to be either more or less predictable as far as cost is concerned than projects that cost less than £1 million, or anywhere in between. Projects lasting longer than 3 years, however, seem to be significantly less predictable in terms of both time and scope than projects of a shorter duration.

- Project duration is less predictable than either project scope or cost, and it's predictability is significantly affected by a number of practices, including the: -
    - Adequacy of company-wide education on the concepts of risk management.
    - Maturity of an organisation's processes for assigning ownership of risks.
    - Adequacy with which a visible risk register is maintained.
    - Adequacy of an up-to-date risk management plan.
    - Adequacy of documentation of organisational responsibilities on the project.
- There is also some evidence, at least for the set of projects in this analysis, that time predictability is probably affected by the: -
    - Adequacy and maturity of processes for identifying and quantifying risks.
    - Adequacy of communication about risk status throughout the project's life.
    - Maturity of the process for maintaining effective baseline control and change control.
- There is also some evidence, at least for the set of projects in this analysis, that cost predictability is influenced by the maturity of the scope change control process.
- For projects undertaken by organisations with a mature scope change control process, the adequacy of providing the right level of information to the right level of authority (thereby enabling effective governance) makes a significant difference.
- The differences in time predictability between those projects employing these practices adequately, and those not doing so can be as much as 40% (from being on schedule to being 40% late).
- The differences in cost predictability between those projects employing these practices adequately, and those not doing so, can be as much as 23% (from 4.5% under budget, to 18% over budget).

5.4.6 A "relative" spin-off from a "positivist" search for effective practices

The aim of this section was not to illustrate "relative" practices, but rather to operate within an "imperfect" epistemological procedure employing more quantitative techniques. Nevertheless, there are relative spin-offs to members participating in this study.

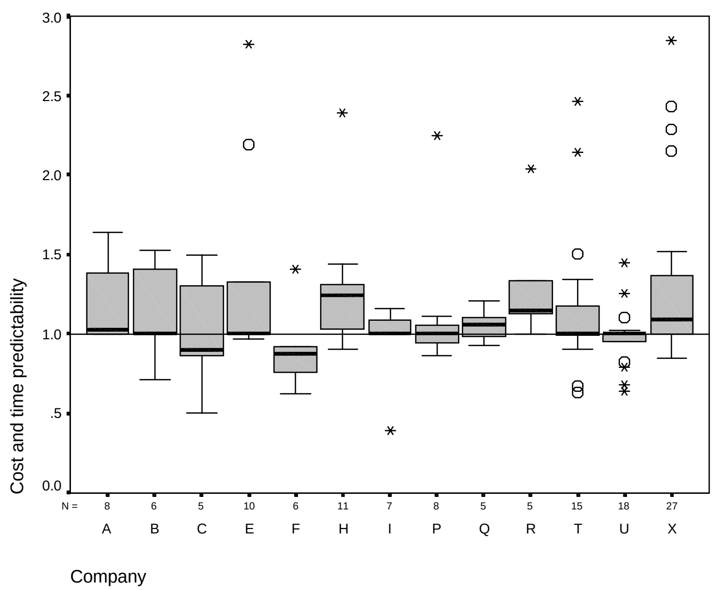

Figure 47: Comparison of relative cost & time predictability by company.

Figure 47 shows how the projects submitted by each company vary in terms of the cost and time predictability. The sample of 136 projects was selected by organisations without clear criteria being set for their inclusion in the sample, so there is no inherent justification to generalise about the performance of this set of projects compared to a "typical" data set (whatever that might mean). On the other hand, the projects were all actual projects carried out by the 23 organisations that submitted them, using the actual project management practices that these organisations employ. There is thus no reason to suppose that the influence of project management practices on the performance of the projects is any different from that for any set of projects managed by organisations like those that contributed projects to the sample.

The fact that member organisations are paying to belong to the programme for the purposes of learning about what project management practices lead to improved project performance, and are continuing to seek to improve their project management practices using the results obtained by the multiple methods in use within the networks, suggests that they themselves have no interest in presenting unrepresentative data.

Clearly, if these projects are typical of their whole portfolio, the senior management of companies C and F will have had rather more pleasant surprises than the management teams of companies H or R. (Company X is an amalgamation of all companies that submitted fewer than five valid projects, since a boxplot is meaningful only if it contains more than five values).

Since data on individual practices is also available, this performance measure can be compared on a company-by-company basis with scores for a range of project management practices. Figure 48 shows the inter-company comparison for risk management practices, that have already been shown to have a significant effect on time predictability.

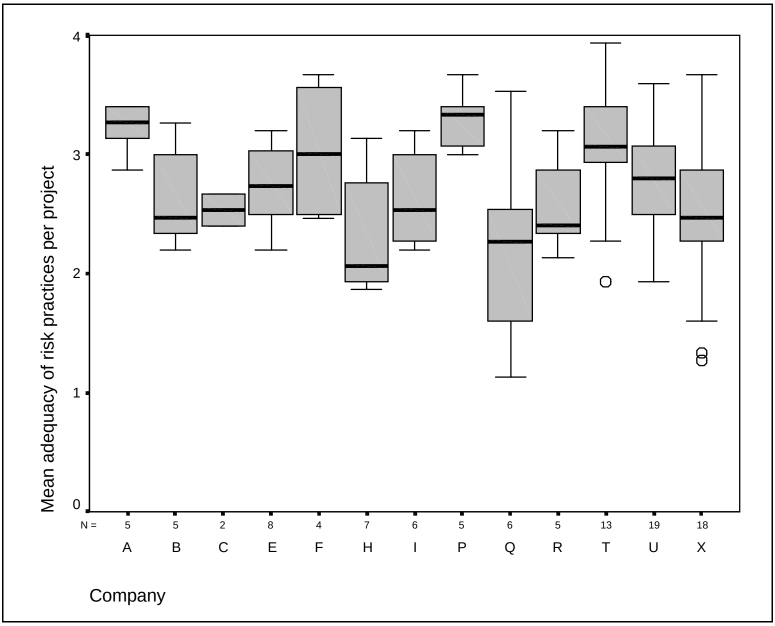

Figure 48: Variability of Mean Risk Management Adequacy between Companies.

In comparing company performance in figure 47, it is reasonable to attribute at least some of the performance of companies F and H to their risk management, and so company H is in a position to estimate the improvement in time predictability (approximately 30%) that might result from improving their mean risk management from "partly adequate" to "largely adequate". They are thus better placed to assess the likely return on investment of a programme to improve risk management across the company.

5.5 Conclusion: The link between project management practices and project performance

This Chapter has reviewed the results obtained from the analysis of data in the two largest sets of data that have so far been assembled during the research. A "relative" study, combining quantitative metrics with qualitative analysis of descriptions of the practices themselves has enabled member organisations to identify their own strengths and weaknesses relative to other companies, has provided substantial input into the description of a project manager's worldview that was developed in Chapter 2, and has provided the impetus for deciding what topics should be studied in further depth in workshops and by working parties.

The insights provided by this "qualitative" work also fed into the development of the more "quantitative" of the two sets of data, illustrating how the different elements of the methodology, each employing different research methods, complement and "feed" each other. At this point it is possible to provide answers to questions 4 and 5 of the six research questions first listed in section 1.6.

Q4 What evidence is there from actual project outcomes that the "benchmark" practices translate into actual project performance?

The research demonstrated that project performance can be measured in different ways, and the performance measures used throughout this research have been actual project results compared with the results that were forecast at the time project plans were authorised. Individual project performance varies widely from project to project, but patterns can be discerned that differentiate cohorts of projects sharing specific practices. Compared to a mean performance of 13% late and 3% over budget, the difference between cohorts of projects demonstrating good and bad project management practice varied from being 40% late to being 6% early, and from being 18% over budget to being 4½% under budget. This constitutes convincing evidence that good project management practices translate into actual improved project performance..

Q5 In the light of project performance, which practices and/or processes can be demonstrated to have a determinative influence on project performance?

The research demonstrated that the practices that determine schedule performance differ from those that affect cost performance and from those that affect time performance. A range of specific risk management practices has the greatest affect on project time predictability, and scope change control *has the greatest affect on cost predictability. The details of the specific practices have been provided in section* 5.4.5.

Answers have now been obtained to the first five of the research questions. They are clearly not the last word, but they do provide encouragement for further work. The sixth question, "How can metrics that are relevant to determinative practices or processes be incorporated into useful predictive models?", presents a focus for that further work.

The final Chapter, Chapter 6, will suggest the directions that such further work might take.

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[1] See Chapter 4 above for a description of the meaning of "approach" and "deployment", and see Appendix P-5 for a complete list of the questions in each topic.

[2] The text for this section of the report was written by John Gandee and Brian Trefty in conjunction with Terry Cooke-Davies, in the service of Human Systems Limited..

[3] Created by Mr. Steve Neuendorf, a U.S. Associate of Human Systems Knowledge Networks Inc., which is the North American company that has the rights to use the methodology described in this thesis.

Chapter 6:

6: Conclusions and further work to be done.

6.1 Summary

It cannot have been easy to read through the whole of this thesis. Writing coherently about a programme that has been evolving continuously during more than six years, and that has been essentially iterative in its nature has presented a significant challenge. The work as a whole has been more akin to a series of operations than to a project or programme! In this final Chapter, therefore, answers to the original research questions will be restated, the contribution made by the research as a whole will be reviewed, and the current plans for further work will be described. This work is expected to include three areas: -

1) Moving towards the genuine use of benchmarking techniques.
2) Improving the comparability of data gathering using extant instruments.
3) Further application of systems thinking and system dynamics, including the development of a more detailed understanding of the project manager’s worldview.

6.2 Answers to the research questions.

In section 1.6 six fairly basic research questions were identified as follows: -

1) What aspects of project management are common to different industries?
2) Which aspects of project management (such as practices or processes) are sufficiently important to project-based organisations that they are felt to be worthy of measurement across industries?
3) What useful cross-industry “metrics” can be developed to measure the relative performance of these practices or processes, and what constitutes the “benchmark” for them?
4) What evidence is there from actual project outcomes that the “benchmark” practices translate into actual project performance?

5) In the light of project performance, which practices and/or processes can be demonstrated to have a determinative influence on project performance?
6) How can metrics that are relevant to determinative practices or processes be incorporated into useful predictive models?

Answers to the first three of these were provided at the end of Chapter 4, and of the fourth and fifth at the end of Chapter 5. No answer has yet been obtained to the sixth question, but the work described later in this chapter is intended to make progress towards an answer.

The answer to question 1 evolved through the development of common agendas and measurement instruments within the networks. The outcomes of the research showed that it was possible to cluster the broad range of topics into the following eleven inter-related topics that could further be clustered into four themes. These four themes were quite distinct from accepted wisdom.

Theme 1: Practices relating to the nature of the particular project

Topic 1: Establishing a strategic framework for the project.

Topic 2: Establishing, specifying and achieving the project's goals.

Topic 3: Defining, specifying, assuring, manufacturing and delivering the product or service.

Topic 4: Identifying, structuring, planning, executing and controlling the work to be carried out.

Topic 5: Managing the uncertainty that is inherent in the uniqueness of the project.

Theme 2 (Topic 6): Practices relating to the stages the project will need to pass through

Theme 3: Practices relating to "beneficial change" that the project is intended to accomplish

Topic 7: Projects as a means of implementing business strategy

Topic 8: Defining, quantifying and harvesting organisational benefits as a result of carrying out the project.

Topic 9: Allocating organisational resources to the project

Theme 4: Practices relating to the people that are associated with the enterprise

Topic 10: Identifying and aligning the interests of the project "stakeholders".

Topic 11: Creating, leading and managing the temporary team who will carry out the project.

All of these have proved of sufficient interest to be measured by members of the network, as is demonstrated by the list of questions in the CPQ listed in Appendix P-5, and the DCI listed in Appendix P-6.

"Relative" metrics have been established using a scale to measure each of 139 different questions in Appendix P-5, and a sample of these metrics is shown in Table 6 in Section 5.3.1. Practices on individual projects, as used to compare project management practice with project performance, can be assessed in terms of the adequacy with which they are practiced, and the maturity of the processes employed (See section 5.4.4).

Project performance can be measured in different ways, and the performance measures used throughout this research have been actual project results compared with the results that were forecast at the time project plans were authorised. Individual project performance varies widely from project to project, but patterns can be discerned that differentiate cohorts of projects sharing specific practices. Compared to a mean performance of 13% late and 3% over budget, the difference between cohorts of projects demonstrating good and bad project management practice varied from being 40% late to being 6% early, and from being 18% over budget to being 4½% under budget. This constitutes convincing evidence that good project management practices translate into actual improved project performance.

The practices that determine schedule performance differ from those that affect cost performance and from those that affect time performance. A range of specific risk management practices has the greatest affect on project time predictability, and scope change control has the greatest affect on cost predictability. The details of the specific practices have been provided in section 5.4.5

6.3 The contribution made by this research programme

In section 1.6 of Chapter 1, six research questions about project management practices were listed. The programme itself predated those questions. The initial step was to create a community of practitioners representing major blue-chip companies to collect empirical evidence that related project management practices to effective performance. In the event, it has indeed provided answers to five of them, and a way forward towards the sixth. But the contribution of the programme as a whole has been much more significant than simply providing these answers. Overall, six contributions to the field of project management can be identified.

6.3.1 A research-driven approach to project improvement.

Many business consultants, particularly those working from within a University setting, claim that they are "research-driven". This usually means, in practice, undertaking interventions in business situations using a method along the lines of that illustrated in figure 11. This programme, on the other hand, has developed a process that practitioners value, and that is truly research-driven. The large and growing number of organisations that are joining the networks demonstrates the value of the programme to them (see appendix L-2 for a chronological record of the growth of the networks, and appendix P-9 for a list of organisations that are, or have been, members during the period covered by this research programme).

The research method whose seven components are illustrated in figure 22, and whose principles are illustrated in figure 12, lies at the heart of the approach to business improvement. That leads naturally to a statement of the second contribution – the research method itself.

6.3.2 An innovative research method.

The method that has been developed as described in Chapter 4, and that is described in section 3.4 seamlessly integrates practice, research and theory through a combination of multiple methodologies based on a sound epistemic foundation. The committed and knowledgeable community of practice supported by the seven structural elements illustrated in Figur 22 apply the methodology illustrated in Figure 12. The method provides a balance across the spectrum from positivism to relativism (see figure 10 in Chapter 3), and allows practitioners to relate to their current business challenges both relevant theory and empirical results from data that they have provided.

6.3.3 Enhancement of the project management worldview.

Chapter 2 exposed the fragmentation and limitations of the existing project management worldview, which is often summarised in "shopping lists" of topics grouped together into suitable categories. This programme has consolidated the worldview into an integrated whole of eleven topics, and given it form and substance by illustrating the inter-relationships between the elements. Finally, the work has enhanced the worldview by illustrating the paths of control that are implicit both within a project, and in the interactions between the project and it's organisational context.

To put it another way, instead of a series of category "buckets" containing shopping lists of individual project management practices and concepts, this work has created a global view that subsumes all the "buckets". Value has then been added by defining it in a logical "cause and effect" sequence.

6.3.4 An international inter-company community of practice.

These first three contributions have enabled the creation of a continuous process with a growing community of practice, which facilitates the discovery, sharing and creation of knowledge about project management and which creates a sustainable framework for better project understanding.

6.3.5 Specific results that pave the way for project management benchmarking.

Chapter 5 illustrated some of the specific results that have been created within the continuous process, which enables member organisations to compare their performance with others, and to make decisions that are data-driven. Member organisations have not only taken data-driven decisions about the traditional areas with which project management has been concerned, but collectively they have also recognised and given substance to qualitative aspects not usually made explicit within the project management worldview.

6.3.6 Locating projects in the context of strategic business improvement.

Project management professional associations have advanced claims that project management is directly concerned with the management of change. This work has located projects in the context of global business improvements, directly linked to the implementation of business strategy.

These are six considerable achievements, but there is still much to be done, and the existing community of practice is already developing plans for what will come next. The final section of this thesis will describe these. They are not the generalised wishes that so often result from linear programmes, and that depend on some reader of the thesis being inspired to carry out follow-on research. They are the next steps in an ongoing cycle of activities for which resources are already available.

6.4 Developing benchmarking techniques for use with projects

An early decision at the commencement of the first cycle of continuous action research was to concentrate on the "practices" side of the benchmarking process (see Chapter 4, figure 13). From these beginnings, although a large number of "metrics" of one kind and another have been provided to members, the actual process of "benchmarking" hasn't yet been fully applied.

The research programme has currently identified three difficulties that need to be overcome, and has developed two ways forward to overcome them.

6.4.1 Three difficulties to overcome

Three reasons for this have been identified, all stemming from the fact that benchmarking is a process discipline, and that project differ from processes (see Chapter 1, Figure 1).

Few project management processes produce the project's primary product or service directly.

The typical measures with which benchmarking operates, are process measures taking input, throughput and output, and comparing meaningful metrics about them, such as efficiency (output per resource unit, or output per input) or cycle time (time to accomplish throughput). The difficulty with these kind of measures as they apply to projects, is that of the five project groups required for a project delivery system (Duncan, 1996), only one – execution – produces directly the product or service that the project is designed to produce. The other four groups (initiation, planning, control and close-out) each produce interim products that bear on the project performance only indirectly.

What this means is that benchmarking will be possible only when the cause and effect linkages are understood between the products of the four indirect project management process groups and the project execution process. The relationships expressed in Figure 6 are a start, but there needs to be considerably more empirically-based research of the kind modelled by Lechler (1998), before the basis exists for meaningful benchmarks to be developed.

Different projects contain different profiles of risk.

As a result of this, it is difficult to compare data from any two projects in the same way that repeated cycles of a continuous process can be compared. Variability within a process is often conforms to a normal distribution, thus allowing statistical process control, and also making benchmarking between similar processes in different organisations statistically valid. In projects, on the other hand, the distribution of risks is more appropriately represented in some asymmetrical form akin to a beta distribution, owing to the asymmetrical opportunities for upside (maximum 100% of planned out-turn) versus downside (virtually an infinite possibility – certainly figures of up to eight-fold or even ten-fold have been returned for some notorious cautionary tales).

What this means is that there will need to be a significantly larger data set than is available at present, identified with sufficiently homogenous groups that it will be possible to segment the data and perform comparative analyses on more homogenous data within a subset. It will also be helpful if some form of project “taxonomy” is developed, allowing the creation of data that is sensibly segmented.

The need for a larger data set is being tackled at the time of writing, as a new version of the data collection instrument is issued not only to the initial network that developed it, but to the Australian-based networks, the US networks (currently in formation) and, with suitable modifications, to the pharmaceutical industry networks.

Projects are executed within differing organisational environments

It has been argued in Chapter 2 that the project management worldview is evolving from first-order to second-order cybernetics. There are thus two separate sets of processes at play, each of which requires its own set of benchmarks. One is the set of project-related processes that operates at a high level to establish projects as a means of implementing strategy, and to control the totality of projects within the organisation. In effect, this set comprises the processes by which the organisation as a whole exercises governance over its project portfolio. The second is the set of processes that are necessary for the delivery of a single project – the set referred to in the first of these three difficulties.

What this means is that the processes for implementing strategy will need to be mapped out as clearly as the processes for delivering a project, and that, just as for the project delivery process groups, the cause and effect linkages will need to be understood for these strategic processes. The work of Erasmus University (Turner and Keegan, 1999; Turner and Keegan, 2000) can be expected to shed light on this topic.

6.4.2 Two ways to progress towards a benchmarking capability

The essence of both of the methods that have been identified so far consists of improving the richness of performance data that is used to provide dependent variables for the project data analysis.

Incorporate existing performance data

The first way to progress this effort lies in the single-industry knowledge networks that have been established as a joint venture between Human Systems Limited and CMR International. CMR International (formerly the Centre for Medicines Research) has an extensive database of the time taken for the development of new active substances (NASs) through different stages in their progress from discovery through to regulatory approval and market launch. The NASs are categorized according to an agreed taxonomy, and CMR International's sponsors, who include virtually all of the world's major pharmaceutical companies, have agreed the intervals through which development stages are measured.

A working party within the pharmaceutical knowledge networks (a group of major pharmaceutical companies in USA and Europe) intends to adopt the DCI so that the performance measures and descriptions of the project types conform to the standards embodied in CMR International's benchmarking database, thus giving direct comparability between the information on project management practices captured using the DCI and industry standard performance measures.

Extend the range of performance measures

A working party from several of the knowledge networks has been developing a deeper understanding of project performance measures, identifying seven discrete areas that could be of significance to different sets of stakeholders in a project (see appendix L-2 for a complete list of the networks' activities, and appendix P-9 for a list of present and past members of the project management benchmarking networks). The seven discrete areas are as follows, and each one is supported by a glossary of terms, and descriptions of appropriate metrics.

- Commercial Success
- Schedule Success
- Quality Success
- Safety & Environmental Success
- Customer Success
- People Success, and
- Organisational Benefits.

A working party within the original network that is currently examining desirable changes to both of the major data collection instruments (the CPQ and DCI) will identify ways to incorporate these metrics into the DCI. This will enable analysis of the kind carried out in Chapter 5 to identify much more sharply which practices lead to which outcomes, and will, in turn, lead to a greater understanding of cause and effect within project management. This demonstrates, incidentally, the inter-connectedness between five different elements of the research method (see Chapter 4 figure 22). The working party (element 4) on project performance was established as a result of a discussion at a workshop (element 3), and was staffed by employees of members of the network (element 1). As a result the data collected will be modified (element 5), thus allowing improved quality of data analysis (element 6).

6.5 Improving comparability of data

The search for improved consistency in data collection is never-ending, but there are two specific ways to improve the quality of data that have already been identified – one for each of the two major instruments (CPQ and DCI).

Improved comparability for the CPQ

During the sixth cycle of the research, data for the CPQ was gathered from one member organisation in a different way, as a pilot. A full-day workshop was arranged for twelve or so representatives of the organisation's project management community (with intimate knowledge of all parts of the organisation), with two external facilitators. In advance of the workshop, each attendee had been sent a questionnaire asking a series of questions about the details of project management processes that were used in their part of the organisation, and the organisational structures that played a part in each of these processes.

During the workshop, small groups of people were given the task of mapping out the organisation's end-to-end project management processes, identifying which organisational units were responsible for and involved in each element of the process. They were also invited to identify ways in which each element of the process worked well, and ways in which it didn't.

At the end of the workshop, the delegates had created the outline of a comprehensive picture of the way that project management functions within the organisation, and this picture was understood and documented by the facilitators, both of whom were familiar with the CPQ. On the basis of the workshop, the facilitators proposed the answers to the CPQ that they considered to be most appropriate (both the numerical scores and the textual evidence for them), and sent them to the organisation's representative in the knowledge networks (who had acted as sponsor for the workshop) for comment. The final submission of data was then agreed between the representative and the facilitators.

This method was found to have two advantages over the present method of data collection (self-scoring). Firstly, the textual evidence for the scores related back to the underlying processes in a way that was transparent to the facilitator. Since one of the facilitators was the author of this thesis, who then carried out the analysis of the CPQ, this enriched the qualitative analysis that was possible, and deepened the researcher's understanding of the specific project management practices employed by that particular organisation. Secondly, the people proposing the scores for both approach and deployment were those most familiar with the constructs behind the scoring guidelines associated with each question. If this were to be applied to all data collected for the CPQ, it would increase comparability between the scores.

As a result of this pilot, networks being brought into existence from the year 2000 onwards incorporate workshops of this kind as a part of the in-house support that is included in their annual fees (element 7 in Chapter 4 figure 22).

Improved data categories for the DCI

The second improvement that is currently being contemplated is a method of assessing the actual project management practices employed on a specific project that can be more readily verified externally than the present judgements about the adequacy of practices and maturity of processes.

The working party on improving the CPQ and DCI that has already been referred to, plans to consider alternative metrics, such as the frequency with which certain activities are carried out. The thinking is that how often an action has been carried out (using a scale such as frequently, occasionally, seldom or never) is more readily verifiable than how adequately an activity has been completed.

6.6 Applying systems thinking and system dynamics

Throughout this research programme, the constructs and principles of system dynamics have never been far below the surface (see for example Figures 2, 6, 7 and 12). There are two directions in which this thinking can now be developed further: firstly in deepening the understanding of elements of the project management worldview, and secondly in developing the systemic worldview diagram (Chapter 2 Figure 7) into a system dynamics model.

6.6.1 Deepening understanding of the project management worldview

Three areas in particular would benefit from being fleshed out: the "people side" of project management, benefits management, and project strategies.

The "people side" of project management.

As was demonstrated in Chapter 2, there is a general recognition in the project management worldview about how much "people issues" matter to projects (through the inclusion of topics such as teamwork and conflict management), but there is a tendency in both literature and research to categorise "people issues" as separate topics alongside and distinct from "technical issues".

This shows itself when the whole worldview is divided into "topics", or "knowledge areas" and people topics are included alongside technical topics. This is the approach taken by the "bodies of knowledge" and writings derived directly from them. The most recent version of the APM Body of Knowledge (Dixon, 2000), for example, labels one of the seven categories of knowledge as "People", and includes five (out of a total of 42) sub-topics: communication, teamwork, leadership, conflict management, negotiation, and personnel management.

There are two particular difficulties with this approach. Firstly, the number of people-related topics is always less than the number of technical topics, creating the impression that project management is more concerned with the technical aspects than with the "people" aspects. How misleading this can be is shown by Lechler's paper (1998) which demonstrates that the opposite is more likely to be true. Secondly, the approach fails to distinguish between the different "categories of knowledge" that are involved in knowing people and those that are involved in mastering techniques (Code, 1998). This was discussed in Chapter 3.

A workshop in March, 2000 held by one of the networks was dedicated to the topic of "human factors on projects". A transport company, a financial services company, a pharmaceutical company and a large retail chain gave case study presentations, and the data on human factors from the CPQ was re-analysed with fresh input from additional networks. In the ensuing discussion, which was facilitated so as to maximise the opportunities for fresh insights and new knowledge to emerge, the 25 or so practitioners present concluded that the results of the approach described above was to fail to give adequate attention to the "people side", and to devote a half of future workshops to "people issues", and a half to "technical issues". A working party drawn from members of more than one working party was established to investigate what aspects of "people management" would be viewed differently, if it were to receive the right attention.

It can be argued that every issue in project management, such as how to create the plan for a feasibility study, has both its technical aspect and its interpersonal aspect. This has been recently demonstrated effectively by Busby (1999) in conjunction with post-project review meetings. One task for future research is to address this "back-to-back people/technique" arrangement, and to find more satisfactory ways of integrating the two aspects.

Benefits management

It was argued in Chapter 2 that benefits management, and in particular the management of expectations about benefits, is a critical element in understanding the principles of control that are at work in the exercise of project governance (see Chapter 2 Figures 7 and 8). There is an additional reason why more work is called for on the management of benefits.

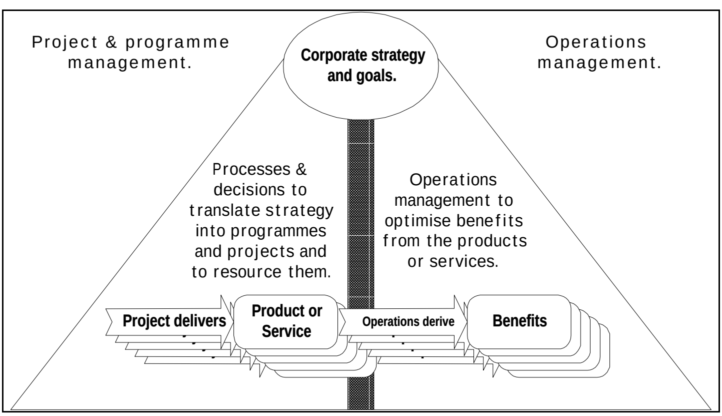

Figure 49: Benefits management and the relationship between projects and operations.

Figure 49 illustrates that in a typical organisation, both project management and operations management (which in many organisations is essentially another name for functional line management) need to work together to ensure that the organisation receives the benefits that are expected from any project. The project delivers a product or service (let us say a new manufacturing facility), and some other group of people (let us say plant management) is then responsible for exploiting the product or service to the benefit of the organisation.

It follows that it is not possible to understand the dynamics of control associated with the management of benefits and expectations about benefits, without casting the net for research and theory wide enough to embrace the relationships between all five of the elements pictured in figure 49:

1. The way corporate strategy is decided and communicated (the oval at the top of the pyramid).
2. The way the strategic intent is translated into a series of resourced programmes and projects (the left hand triangle).
3. The means by which individual projects and the interactions between related projects are managed (the left hand arrow and box)
4. The relationship between those people who need to operate a product or service, and the project team that are delivering it (the right hand arrow and box).
5. The way that the conduct of ongoing operations (the right hand triangle) interacts with the other four elements of the figure.

This relates to all three of the sections that remain in this chapter, and influences the thinking behind each of them.

Understanding project strategies

The analysis of project level data in Chapter 5 showed that no correlation exists within the current data set between project and contract strategies and project results (see Chapter 5 Figure 40, and the discussion that follows it). And yet the project strategy represents an important element in both the first-order and second-order control loops for a project (see Chapter 2 Figures 7 and 8 and the discussion that follows them).

More work is clearly called for in understanding what it is about project strategies that can influence project performance, and this will require developing widely accepted ways of talking about strategies that contain sufficient “granularity” to be able to distinguish between those that prove to be successful and those that don’t. The work of Miller and Hobbs (2000), and of Per Willi Hetlund and his colleagues at EPCI[1] may well provide some direction, and assist in framing the right questions to ask at a workshop, or through a working party and, ultimately, to include in an instrument for the collection of data for analysis.

6.6.2 Developing a predictive model

At the conclusion of Chapter 5, it was pointed out that the unanswered research question from the six that this programme attempted to find answers to, was the development of a predictive model that would enable practitioners to predict the outturn of their project in the light of the practices they were adopting or proposing to adopt. This could conceivably take a number of forms. One could be a regression equation[2], in which information about the project characteristics and the characteristics of the system for managing the project are fed in, and the probability of achieving the project’s goals is predicted. A second could be some form of dynamic model, in which relationships such as those illustrated in Figure 7 are built into a relational model that allows some form of project simulation, with the resulting output serving to indicate what performance can be expected from what practices under what circumstances[3].

As the continuous action learning research produces more empirical evidence about effective practices, it will become possible to construct one or more such predictive models. Two steps towards that are currently planned as a continuation of this research: developing a new research instrument to collect empirical data that supplements that produced by existing instruments or their subsequent development, and building a “flight simulator” to act as a predictive model.

Developing a new research instrument

The discussion about people, about benefits and about strategies above has highlighted the need for a research instrument in addition to the CPQ and the DCI. The CPQ, based as it is on a “relative” paradigm provides qualitative information and relative metrics about project management practices employed throughout the elements of the system illustrated in Chapter 2 figure 7 and in figure 47 above. The DCI, based on a more pragmatic "positivist" paradigm links those practices that directly influence the management of an individual project with the performance of that project (element 3 in figure 47).

What is missing is an equivalent instrument to the DCI that relates practices in elements 1, 2, 4 and 5 in Figure 49 to the actual performance of the entire organisation's project and programme portfolio.

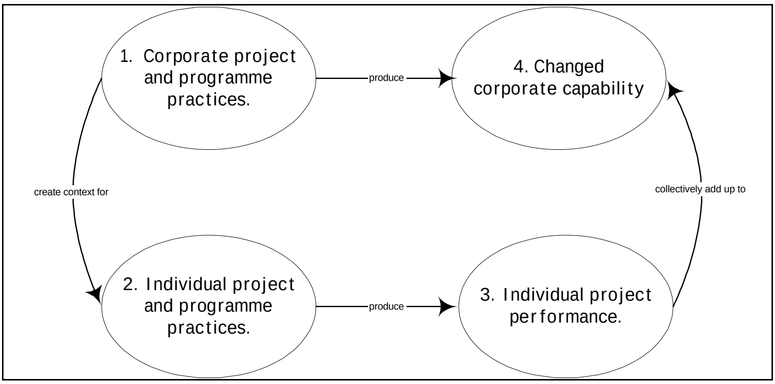

Figure 50: How practices relate to performance.

In Figure 50, if the CPQ collects qualitative data about elements 1 (corporate practices) and 2 (project practices), and the DCI collects quantitative data linking element 2 (project practices) to element 3 (project performance), then what is required now is an instrument that links element 1 (corporate practices) to element 4 (changed corporate capability).

A working party similar to the one that produced the DCI Mk II (see Chapter 4 Figure 17 and Appendix P-3 and P-4) is the recommended method within continuous action research. The insights to emerge from further work on people, on benefits and on strategies will be included in the terms of reference. Difficulty is anticipated in developing suitable performance measures, and it may well be that the new instrument will need as many iterations as the DCI has required (four at the time of writing, with a fifth planned).

Developing a "flight simulator"

It is possible that out of the data collected by the DCI and the new instrument described above sufficient conclusions will be possible to allow the creation of a predictive regression equation. If they are, one will be constructed.

On the other hand, even the best regression equation simply reveals what is likely to happen if a particular combination of practices is applied to a specific project in a specific context. What it won't do, is provide guidance on the best strategy for changing from the particular combination of practices being evaluated to a different combination that are both practical to implement, and that give improved predicted performance.

For this, a dynamic model more akin to a "flight simulator" is required.

At the beginning of the second cycle of action research (see Chapter 4 Figure 15) an attempt was made to build such a model, as the basis for the DCI MkI. In terms of the current understanding of the situation as described in this thesis, the model was simplistic, and focused exclusively on the area of concern covered by the then DCI.

Armed with the insights that are likely to appear from the ongoing continuous action research incorporating the further work described in this Chapter, such a flight simulator appears to be a more grounded hope.

6.7 Conclusion

This chapter has reviewed the success of the research programme to date and plans for the future. The programme will be carried forward vigorously, to build on the platform of what has been achieved to date by:-

1. Gathering more data from the continuous action research programme as more and more organisations join the family of project management knowledge networks.
2. Improve existing data collection instruments through: -
    a. Incorporating existing performance data.
    b. Extending the range of performance measures included in the DCI.
    c. Improving comparability of data provided as input to the CPQ.
    d. Improving the scoring categories used in the DCI.

  e. Incorporating finer grained questions about project strategies into the DCI.

3. Create a new data collection instrument that: -
    a. Incorporates insights from “gaps” in the current worldview.
    b. Builds on the networks’ collective understanding about “people” aspects of project management.
    c. Investigates the processes and structures for managing benefits and expectations.
    d. Relates corporate level practices to corporate level performance.
4. Creating well-grounded predictive models.

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[1] Discussed personally with the author at the Haugesund workshop described in appendix P-2.
[2] Such an equation is currently in use commercially by Independent Project Analysis Inc. (IPA). It derived its information from a large database of information about projects supplied by the US Department of Energy.
[3] Such models are available commercially to deal with specific project delivery systems (Pugh-Roberts) and particular project contexts (Vité).

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Towards Improved Project Management Practice.

Appendices (Portrait).

Appendix P-1

Towards the building blocks for an "atlas" of PM knowledge.

This document summarises the steps that were followed in compiling the "core elements" of a project manager's worldview, as described in Chapter 2.

1. A comparison was made of the "high-level" categories of concepts that are employed in each of six different BOKs – APM, PMI, ICB, CRMP, IJPM and the de-facto BOK used by members of Terry Cooke-Davies' company's project management knowledge networks.

   The terms are stripped of their explicit knowledge structures, and arranged alphabetically using the actual terms in the BOKs. (Table 1)

2. Each of the terms used in each of the six BOKs was related to one or more of Max Wideman's terms in the "single-term glossary" that he provided in preparation for this workshop, after working through the outcomes from Norfolk Beach, 1999. (Wideman, 2000).

   The guiding principle was that of Occam's razor, and wherever a single term in Wideman's glossary was thought to approximate to the concept in the BOK, then that single terms was used. This resulted in a narrowing down of Wideman's list from over 3000 to 202. (Table 2)

3. The article in IJPM (Themistocleous and Wearne, 2000) that reviewed the topics that had appeared in articles in IJPM between 1984 and 1998 and in PMJ between 1990 and 1998 (Summarised in Table 3) was similarly related to Wideman's glossary, and a final shortlist of 60 terms was prepared (Table 4) containing only terms that were reviewed by Themistocleous & Wearne (which took precedence) or which occurred in two or more of the six BOKs included in Table 1.

   The sequence of terms in Table 4 consists of a three-factor sort: firstly, the percentage of topics in articles between 1984 and 1998 in IJPM; secondly, the number of

BOKs in which they appear; and thirdly, alphabetical order. The origins of the data can be seen in the more detailed analysis provided at Chapter 2 Appendix 2.

4. The definitions of each of these sixty terms, including variant definitions (Table 5) was imported into an Nvivo file, and coded according to a series of constructs that appeared to summarise the contribution of the term to the body of knowledge. The analysis collected the data in two ways: firstly, using a simple 3 x 2 matrix, Table 3 in Chapter 2 was constructed, and subsequently a more detailed analysis of the constructs, Table 6 in this Appendix was used as the basis for the narrative section of chapter 2.
5. The narrative does not follow Table 6 in all details, since the main constructs were allowed to “emerge” as the narrative unfolded, and as dialogue was entered into with the corpus of literature about project management.
6. An abridged version of this document, containing Tables 1 to 4 and points 1 to 3 above, was sent to each particpant in the Global “Bodies of Knowledge” Workshop at Haugesund in June, 2000, where it proved to be a valid basis for developing six alternative knowledge structures for the global body of project management knowledge. Thus the 60 terms (although not the over-arching narrative that links them) has received a degree of validation from an eminent group of leading practitioners and academics from UK, Europe, Ukraine, India, Australia, U.S.A, Canada and Japan.

Table 1: Six BOKs Summarised using their own Categories

PMI	APM	IPMA
1. Activity definition	1. Change control	1. Business processes
2. Activity duration estimating	2. Closeout	2. Communication
3. Activity sequencing	3. Communication	3. Configuration and changes
4. Administrative closure	4. Conflict management	4. Conflicts and crises
5. Communication planning	5. Control and coordination	5. Content, scope
6. Contract administration	6. Cost control	6. Finance and accounting
7. Contract closeout	7. Delegation	7. Informatics on projects
8. Cost budgeting	8. Estimating	8. Information, documentation, reporting
9. Cost control	9. Finance	9. Leadership
10. Cost estimating	10. Industrial relations	10. Legal aspects
11. Information distribution	11. Information technology	11. Management by projects
12. Initiation	12. Integration	12. Management of change
13. Organizational planning	13. Law	13. Marketing, product management
14. Overall change control	14. Leadership	14. Negotiations, meetings
15. Performance reporting	15. Management development	15. Organizational learning
16. Procurement planning	16. Marketing and sales	16. Performance measurement
17. Project plan development	17. Mobilisation	17. Permanent organization
18. Project plan execution	18. Negotiation	18. Personnel development
19. Quality assurance	19. Operational/technical management	19. Problem solving
20. Quality control	20. Organization design	20. Procurement, contracts
21. Quality planning	21. Performance measurement	21. Project closeout
22. Resource planning	22. Planning	22. Project context
23. Risk identification	23. Post project appraisal	23. Project controlling
24. Risk quantification	24. Procurement	24. Project cost and finance
25. Risk response control	25. Programme management	25. Project development and appraisal
26. Risk response development	26. Project appraisal	26. Project management implementation
27. Schedule control	27. Project environment	27. Project objectives and strategies
28. Schedule development	28. Project life cycle	28. Project organization
29. Scope change control	29. Project management	29. Project phases and life cycle
30. Scope definition	30. Project strategy	30. Project quality
31. Scope planning	31. Project success/failure criteria	31. Project risks
32. Scope verification	32. Quality	32. Project start up
33. Solicitation planning	33. Risk management	33. Project structures
34. Solicitation	34. Safety	34. Project success and failure criteria
35. Source selection	35. Scheduling	35. Projects and project management
36. Staff acquisition	36. Systems and procedures	36. Resources
37. Team development	37. Systems management	37. Safety, health and environment
38.	38. Team building	38. Standards and regulations
	39. Value management	39. System approach and integration
	40. Work definition	40. System management
		41. Teamwork
		42. Time schedules

IJPM	CRMP	HSL Knowledge Networks
1. Audits, health checks	1. Budgeting and cost management	1. Access to prior experience
2. Bidding	2. Business case	2. Archiving project records.
3. Cash flow management	3. Change control	3. Benefits management.
4. Change	4. Communication	4. Bid management.
5. Claims	5. Configuration management	5. Change control.
6. Commercial law	6. Conflict management	6. Communication.
7. Commissioning and closeout	7. Design and development	7. Configuration management
8. Competence	8. Design, production and handover management	8. Contract strategy.
9. Configuration	9. Earned value management	9. Control systems
10. Contract administration	10. Financial management	10. Corporate organisation structure
11. Cost	11. Handover	11. Cost planning.
12. Culture	12. Information management	12. Customer management
13. Design and appraisal	13. Leadership	13. Defining requirements.
14. Environmental	14. Legal awareness	14. Estimating impact of project changes.
15. Ethics	15. Life cycle design and management	15. Estimating principles and concepts.
16. Finance	16. Marketing and sales	16. Estimating processes.
17. Finance and accounting	17. Modelling and testing	17. Handover and commissioning.
18. Functionality, value	18. Negotiation	18. Integration
19. Human resource management	19. Opportunity identification	19. Management by projects
20. Implementation	20. Organization structure	20. Management of change
21. Implementing strategy	21. Organizational roles	21. Organisational culture
22. Individuals	22. Personnel management	22. Organisational learning.
23. Information technology	23. Post-project evaluation review (O&M/ILS)	23. Performance measurement.
24. Insurance	24. Procurement	24. Perspectives and relationships.
25. Integration - life cycle	25. Production	25. Portfolio management
26. International projects	26. Programme management	26. Post-project reviews.
27. Legal	27. Project context	27. Pre-project planning
28. Management structure	28. Project management	28. Procurement.
29. Managing and leading	29. Project success criteria	29. Programme Management.
30. Managing programmes	30. Quality management	30. Project closeout.
31. Managing projects	31. Requirements management	31. Project life-cycle.
32. Marketing	32. Resource management	32. Project management information systems
33. Materials, purchasing and supply	33. Risk management	33. Project methodology.
34. Operations	34. Safety, health and environment	34. Project metrics and measures of project success.
35. Organization design	35. Strategy/project management plan	35. Project organisation.
36. Organization resources	36. Teamwork	36. Project start-up.
37. Partnerships, alliances	37. Technology management	37. Project strategy.
38. PEST	38. Time scheduling/phasing	38. Project Teams
39. Processes, procedures	39. Value engineering	39. Quality management processes.
40. Procurement	40. Value management	40. Recording lessons learned.
41. Progress	**41.** Work content and scope management	41. Relationship between project planning and estimating
42. Proposal and feasibility		42. Resource planning.
43. Quality		43. Risk assessment/analysis.
44. Risk		44. Risk identification.
45. Safety and health		45. Risk management.
46. Scope of work		46. Risk response control.
47. Stakeholders		47. Schedule planning - critical path methods.
48. Start up		48. Scope planning - work definition - work breakdown structures.
49. Strategy		49. Special Situations
50. Success and strategy		50. Systems management
51. Systems approach		51. The Project Management Community
52. Systems, project office		52. Tools to support estimating.
53. Taxation		53. TQM in project-based organisation.
54. Teams		**54.** Value management.
55. Technology, innovation		
56. Time		
57. Value and benefit		
58. Value, benefit, finance		

Table 2: Wideman's Terms Equivalent to BOKs Categories

1	Accounting	69	Legal	136	Project startup
2	Activity definition	70	Legal aspects	137	Project strategy
3	Activity duration estimating	71	Legal awareness	138	Project structure
4	Alliance	72	Lessons learned	139	Project success/failure criteria
5	Archive	73	Life cycle	140	Project team
6	Audit	74	Management by projects	141	Proposal
7	Benefits	75	Management development	142	Quality
8	Benefits management	76	Management structure	143	Quality assurance
9	Bid	77	Managing	144	Quality control
10	Bidding	78	Managing change	145	Quality management
11	Budgeting & cost management	79	Marketing	146	Quality planning
12	Business case	80	Material	147	Regulations
13	Business processes	81	Meeting	148	Relationship
14	Cash flow management	82	Methodology	149	Reporting
15	Change	83	Mobilization	150	Requirements
16	Change control	84	Modelling	151	Requirements management
17	Claim	85	Negotiation	152	Resource management
18	Close-out	86	Operation	153	Resource planning
19	Commercial	87	Opportunity	154	Risk
20	Commissioning	88	Organization	155	Risk analysis
21	Communication	89	Organization plan	156	Risk assessment
22	Communications plan	90	Organization resources	157	Risk identification
23	Community	91	Organization structure	158	Risk management
24	Competence	92	Organizational design	159	Risk quantification
25	Configuration	93	Organizational learning	160	Risk response control
26	Configuration management	94	Overall change control	161	Risk response development
27	Conflict management	95	Partnering	162	Safety
28	Content	96	Performance measurement	163	Sales
29	Contract administration	97	Performance measurement techniques	164	Schedule control
30	Contract strategy	98	Performance reporting	165	Schedule development
31	Control & coordination	99	Personnel development	166	Scheduling
32	Control system	100	Personnel management	167	Scheduling techniques
33	Cost	101	Phasing	168	Scope
34	Cost budgeting	102	Planning	169	Scope change control
35	Cost control	103	Politics	170	Scope definition
36	Cost estimating	104	Portfolio management	171	Scope management
37	Cost plan	105	Post-project appraisal	172	Scope of work
38	Crisis	106	Post-project evaluation review	173	Scope verification
39	Culture	107	Post-project review	174	Solicitation
40	Customer	108	Problem solving	175	Solicitation planning
41	Delegation	109	Procedure	176	Source selection, in procurement
42	Design	110	Process	177	Staff acquisition
43	Design & handover	111	Procurement	178	Stakeholders
44	Documentation	112	Procurement planning	179	Standards
45	Earned value management	113	Production	180	Start-up
46	Environmental	114	Program management	181	Strategy
47	Estimating	115	Progress	182	Success, project
48	Ethical	116	Project appraisal	183	System integration
49	Feasibility	117	Project close-out	184	Systems and procedures
50	Finance	118	Project context	185	Systems approach
51	Financial management	119	Project control	186	Systems management
52	Functionality	120	Project cost	187	Team
				188	Team building

53	Hand-over	121	Project development	189	Team development
54	Implementation	122	Project environment	190	Teamwork
55	Individual	123	Project financing	191	Technology management
56	Industrial relations	124	Project life cycle	192	Testing
57	Information	125	Project management	193	Time
58	Information distribution	126	Project management information system	194	Time scheduling
59	Information management			195	Tools
60	Information systems	127	Project management plan	196	Total quality management
61	Information technology	128	Project objective	197	Value
62	Initiation	129	Project office	198	Value engineering
63	Insurance	130	Project organization	199	Value management
64	Integration	131	Project phase	200	Work breakdown structure
65	International projects	132	Project plan development	201	Work definition
66	Law	133	Project plan execution	202	Work management
67	Leadership	134	Project quality		
68	Leading	135	Project risk		

Table 3: Analysis of Articles in IJPM 1984 – 1998 and PMJ 1990 – 1998

	Knowledge element	**IJPM 84-98**	**IJPM 90-98**	**PMJ 90-98**
1	Business need & case	1	1	0
2	Marketing and sales	4	3	5
3	Goals, objectives & strategy	28	14	5
4	Strategic implementation plan	11	6	2
5	Project appraisal	20	13	10
6	Financial management	21	9	3
7	Systems management	21	13	4
8	Project management	148	72	26
9	Programme management	12	11	3
10	Project life cycles	13	10	5
11	Integrative management	6	3	5
12	Project context	26	18	2
13	Requirements management	13	8	1
14	Design management	9	5	3
15	Project management plan	48	31	2
16	Success criteria	18	15	7
17	Project launch	12	7	0
18	Work management	20	13	9
19	Schedule management	52	37	25
20	Resources management	19	8	16
21	Cost management	28	10	14
22	Risk management	65	57	14
23	Value improvement	3	3	1
24	Quality management	23	18	7
25	Safety, health and environment	4	3	2
26	Project organisation	52	37	14
27	Project monitoring and control	35	23	17
28	Performance measurement	19	14	11
29	Configuration management and change control	14	13	3
30	Information management	95	58	29
31	Procurement	7	5	8
32	Supply chain management and logistics	3	2	4
33	Purchasing	1	1	0
34	Contract planning and administration	47	27	17
35	Legal awareness	8	4	6
36	Teamwork	19	15	12
37	Leadership	17	16	10
38	Conflict management	6	5	2
39	Stress management	2	2	0
40	Personnel management	35	18	11
41	Industrial relations	2	1	2
42	Testing, commissioning and hand-over/acceptance	1	0	0
43	Project close out	0	0	0
44	(Post-) project evaluation review	7	4	3
	Total number of papers	538	339	210
	Total number of topics	995	633	320

(Themistocleous and Wearne, 2000)

Table 4: Candidates for Core Elements of the Pm Worldview

Rank	**No.**	**Single Term Glossary**	**% 84-98**	**BOKs**
1	125	Project management	28%	4
2	59	Information management	18%	1
3	158	Risk management	12%	3
4	130	Project organization	10%	2
5	164	Schedule control	10%	1
6	127	Project management plan	9%	1
7	29	Contract administration	9%	2
8	98	Performance reporting	7%	1
9	100	Personnel management	7%	1
10	33	Cost	5%	1
11	181	Strategy	5%	1
12	118	Project context	5%	2
13	145	Quality management	4%	1
14	186	Systems management	4%	2
15	51	Financial management	4%	1
16	116	Project appraisal	4%	2
17	152	Resource management	4%	2
18	190	Teamwork	4%	2
19	96	Performance measurement	4%	1
20	182	Success, project	3%	2
21	67	Leadership	3%	3
22	16	Change control	3%	3
23	26	Configuration management	3%	3
24	124	Project life cycle	2%	3
25	151	Requirements management	2%	1
26	114	Program management	2%	4
27	136	Project startup	2%	2
28	42	Design	2%	2
29	71	Legal awareness	1%	1
30	111	Procurement	1%	5
31	106	Post-project evaluation review	1%	1
32	27	Conflict management	1%	3
33	64	Integration	1%	3
34	79	Marketing	1%	3
35	162	Safety	1%	3
36	163	Sales	1%	2
37	56	Industrial relations	0%	1
38	12	Business case	0%	1
39	192	Testing	0%	1
40	117	Project close-out	0%	2
41	21	Communication		4
42	18	Close-out		3
43	50	Finance		3
44	85	Negotiation		3
45	137	Project strategy		3
46	142	Quality		3
47	199	Value management		3
48	15	Change		2
49	35	Cost control		2
50	39	Culture		2
51	47	Estimating		2
52	53	Hand-over		2

53	74	Management by projects	2
54	78	Managing change	2
55	91	Organization structure	2
56	92	Organizational design	2
57	93	Organizational learning	2
58	97	Performance measurement techniques	2
59	139	Project success/failure criteria	2
60	153	Resource planning	2

Table 5 – Definitions of Terms

Term	Definition	Source
Business Case	A document developed towards the end of Phase 1 - Concept, to establish the merits and desirability of the project and justification for further project definition (Project Phase 2). [D00193]	[PMGdLns]
Business Case	A document used to justify the commitment of resources to a project. [D00194]	[WST]
Business Case	A document that defines why the project is required and what the change is to be. It should include an outline of the project's objectives, deliverables, time, cost, technical, safety, quality and other performance requirements, and the major project risks and upside opportunities. It might also include information on the competitive impact, resource requirements, organizational impacts, key performance indicators and critical success factors of the project and its outcome. The project's sponsor, the person responsible for defining and developing the project against the business case, should 'own' the business case. [D03428]	[CRMP `]
Business Case	A document which provides justification for the commitment of resources to a Project or Programme. [D03805]	[PNG]
Change	The substitution of one thing in place of another. [D00213]	[FWH]
Change	An increase or decrease in any of the project characteristics. [D00214]	[PMK87]
Change	A systematic way of reaching an intended outcome. Philosophically, change is what project management is all about. [D02643]	[RMW]
Change Control	The process of accepting or rejecting changes to the project's baselines. Lack of change control is one of the most common causes of scope creep. [D02460]	[PD-U]

Change Control	The process of implementing procedures which ensure that proposed changes are properly assessed and, if approved, incorporated into the project plan. Uncontrolled changes are one of the most common causes of delay and failure. . [D03807]	[PNG]
Change Control	The risk abatement process of accepting or rejecting changes to the project's baselines, based on predetermined criteria or "Trigger Points". Of particular value in avoiding scope creep. [D04317]	[26]
Close-out	The completion of all work on a project. *Editor's Note: See also Transfer of Care, Custody and Control.* [D00235]	[WST]
Close-out	The completion of project work once the project has been implemented. The phase at the end of the project lifecycle just before the operations begin. *Editor's Note: Confusingly, this period is often called Start-Up since this refers to the start-up of the facility.* [D03809]	[PNG]
Communication	The transmission of information so that the recipient understands what the sender intends. [D00252]	[WST]
Communication	The effective transmission of information so that the recipient understands clearly what the receiver intends. Communication media may take several forms: Oral, written, textural, numerical, graphic, body language, paper, electronic, physical, etc. In short, bring together and control effectively those things which need inter-relating in order for the project to be properly assessed, configured and implemented. [D03810]	[PNG]
Communication	The transmission and validated receipt of information so that the recipient understands what the sender intends, and the sender is assured that the intent is understood. [D04318]	[26]
Configuration Management ("CM")	A management discipline that applies technical and administrative direction to the development, production and support life cycle of a configuration item. This discipline is applicable to hardware, software, processed materials, services and related technical documentation. CM is an integral part of life-cycle management. [D00280]	[ISO]
Configuration Management	Management of the methods used to control the software and hardware being developed; often used interchangeably with change control. [D00281]	[SPM 304-9]
Configuration Management	The process of defining the configuration items in a system, controlling the release and change of those items throughout the project, recording and reporting the status of configuration items, and verifying the completeness of configuration items. [D00282]	[WST]

Configuration Management ("CM")	A procedure for applying technical and administrative direction and supervision to: 1. Identify and document the functional and physical characteristics of an item or system 2. Control any changes to such characteristics 3. Record and report the change, process, and implementation status 4. Audit the items and system to verify conformance to contractual requirements The CM process must be carefully tailored to the capacity, size, scope, nature and complexity of the system involved, and its phase in the project life cycle. [D02289]	[DSMC]
Configuration Management	The process of designing, making and assembling the components of a project's deliverable in order to achieve the required functionality. [D02622]	[23]
Configuration Management	The process of ensuring that the project delivers everything it is supposed to - physical products and assets, quality products, documentation, deliverables etc. - such that there is complete assurance on delivery integrity. It is particularly concerned with managing the status of pending and approved changes to the project deliverables and with managing the information that define the configuration status. It is closely related to Change Control. [D03429]	[CRMP]
Configuration Management	The process to: • Define the evolving baselines of the project • Control changes to the approved baselines • Record and communicate the change and change status [D04041]	[CSM]
Conflict Management	The ability to manage conflict effectively. [D00283]	[WST]
Conflict Management	The process by which the project manager uses appropriate managerial techniques to deal with the inevitable disagreements, both technical and personal in nature, that develop among those working toward project accomplishment. [D00284]	[PMK87]

Conflict Management	Handling of conflicts between project participants or groups in order to create optimal project results. [D00285]	[NPMT]
Conflict Management	The art of managing conflict creatively and productively. This art channels these conflicts so that the result is positive and preferably synergistic, rather than destructive. [D03430]	[CRMP]
Conflict Management	The art of managing conflict effectively. Nearly all projects encounter conflict. It occurs at all levels largely because there are so many different parties working together each with their own aims. Also, people come together who often barely know each other and yet are asked to work together under pressure. The art of conflict management is to channel conflicts so that the result is positive rather than destructive. [D03815]	[PNG]
Contract Administration	Monitoring and control of performance, reviewing progress, making payments, recommending modifications and approving contractor's actions to ensure compliance with contractual terms during contract execution. [D00321]	[PMK87]
Cost	Cost can be divided into internal and external expenses. External costs can be controlled by contracts and budgets for each phase of a project and for each deliverable or work product. Internal cost is the cost of project resources. [D00377]	[WST]
Cost	See Project Cost. [D00378]	
Cost	The cash value of project activity. [D00379]	[PMK87]
Cost Control	System for planning and following up disbursements in relation to budget. [D00389]	[NPMT]
Cost Control	The processes of gathering, accumulating, analyzing, reporting and managing the costs on an on-going basis. Includes project procedures, project cost changes, monitoring actual versus budget, variance analysis, integrated cost/schedule reporting, progress analysis and corrective action. [D00390]	[PMK87]
Cost Control	The discipline of reconciling planned and actual money figures to physical parts of the project. Cost control also involves careful treatment of changes (including claims), trend forecasting and authorization for payment. Cash flow forecasting is also a cost control function. [D03820]	[PNG]
Culture	The integrated pattern of human knowledge, belief, and behavior that depends upon people's capacity for learning and transmitting knowledge to succeeding generations. *Editor's Note: See also Social Factors.* [D00465]	[PMK87]

Culture	A person's attitudes arising out of their professional, religious, class, educational, gender, age and other backgrounds. [D02628]	[23]
Design	The creation of final approach for executing the project's work. [D00513]	[PMK87]
Design	The activity of defining what is to be delivered. To a significant extent the design will influence how the product will be made. [D03434]	[CRMP]
Design	In construction, defining the construction requirement (including the functional relationships and technical systems to be used, such as architectural, environmental, structural, electrical, mechanical, and fire protection), producing the technical specifications and drawings, and preparing the construction cost estimate. [D03493]	[GAT]
Design	The process of developing and documenting a solution to a problem using technology experts and tools. [D04073]	[CSM]
Estimating	Calculating approximately the probable cost or value. [D00624]	[NPMT]
Estimating	The act of combining the results of post project reviews, metrics, consultation and informed assessment to arrive at time and resource requirements for an activity. [D00625]	[WST]
Estimating	An assessment of the anticipated cost of implementing all or part of a project. [D03842]	[PNG]
Finance	Money available for disbursement. Typically refers to the source of funding for project activities. [D02768]	[PD-U]
Financial Management	Management of the financial activities of the organization, program, project or major work package. [D02773]	[PD-U]
Hand-Over	A process of transfer of responsibility for all or part of a project or its deliverables. Typically, this takes place at the end of a project or a major part thereof. See also Completion and Project Close-out. [D02819]	[PD-U]
Industrial Relations	A broad area of responsibility within an organization that includes human resources management activities and the administration of union agreements and seeks to maintain a positive image for the organization through public relations type activities. [D02844]	[PD-U]
Industrial Relations	An organizational function that deals with the relationship that exists between management personnel and the unions within an organization. [D02845]	[PMDT]
Information Management	The proper organization and appropriate control of information transmitted by whatever means and including records management. [D02852]	[PD-U]

Information Management	The management of the systems, activities, and data that allow information in a project to be effectively acquired, stored, processed, accessed, communicated, and archived. There should be a valid audit trail of this communication process. Projects generate and absorb significant quantities of information. It is important that the project has an effective information management system. [D03440]	[CRMP]
Integration	A way of terminating a project by bringing project team members back into the organization and distributing project results and outcomes among existing functions. [D00857]	[OTOB 271-4]
Integration	The process of bringing people, activities and other things together to perform effectively. [D00858]	[WST]
Integration	The bringing of people and things together to perform effectively. [D03863]	[PNG]
Integration	The successive combining and testing of system hardware assemblies, software components, and operator tasks to progressively prove the performance and compatibility of all components of the system. [D04119]	[CSM]
Leadership	The process by which the project manager influences the project team to behave in a manner that will facilitate project goal achievement. [D00918]	[PMK87]
Leadership	Getting others to follow direction. [D00919]	[WST]
Leadership	The art of getting others to want to do something that you are convinced should be done. [D02336]	[20]
Leadership	An ability to get things done well through others. It requires: • A vision of the destination • A compelling reason to get there • A realistic timetable, and • A capacity to attract a willing team [D02337]	[SU]
Leadership	The art of influencing others to willingly strive for the completion of group goals. [D02948]	[PMDT]
Leadership	The ability to identify what work has to be done and then to select the people who are best able to tackle it. It is about setting goals and objectives and generating enthusiasm and motivation amongst project team members and stakeholders to work towards those objectives. [D03443]	[CRMP]

Leadership	The art of getting others to follow, whereas management is defined as the art of getting others to do what one cannot necessarily do oneself, i.e. by organizing, planning , controlling and directing resources. [D03865]	[PNG]
Legal Awareness	Recognition of prevailing and relevant law. [D02935]	[PD-U]
Legal Awareness	An awareness of the relevant legal duties, rights, and processes which govern in a particular project situation. It may cover potential causes of disputes, liabilities, breaches of contract, means of resolving a dispute, and legal basics of industrial relations. [D03444]	[CRMP]
Management by Projects	The separating out of discrete activities by corporate management, designating them as projects, and managing them using the tools and techniques of project management. [D00976]	[RMW]
Managing Change	A term that is used to characterize Project Management. [D02981]	[PD-U]
Marketing	The process or technique of promoting, selling, and distributing a product or service. [D02992]	[Webster]
Marketing	The process of matching the abilities of an organization with the existing and future needs of its customers, to the greatest benefit of both parties. The result is an exchange in which the organization receives income through the meeting of customers' needs and customers receive benefits that satisfy their expectations. [D03447]	[CRMP]

Marketing	The collection of information on market requirements, planning to select and budgeting to pursue segments of those requirements, actively pursuing those segments and analyzing results of the effort to improve the marketing strategy. It includes: • Market research or intelligence • Profitability planning • Distribution planning • Advertising and promotion • Creating and keeping customers, and • Organizing sales to maximize market share. Marketing requires seeing the whole business from the client or buyer's point of view. Business development, selling and securing a contract are all subsets of marketing. [D04303]	[SU]
Negotiation	The art of achieving what you want from a transaction, leaving all other parties involved content that the relationship has gone well. [D01066]	[WST]
Negotiation	A process by which two or more people who begin with conflicting positions attempt to reach an agreement by modifying their original positions or by developing new proposals that reconcile the interests underlying them. [D02727]	[PMH p331]
Negotiation	The art of achieving to the greatest extent possible what you want from a transaction while leaving all parties sufficiently content that the relationship subsequently works well. All projects involve the need for negotiation. [D03448]	[CRMP]
Negotiation	The process by which we obtain what we want from somebody who wants something from us. [D03617]	[17]
Negotiation	A bargaining process between two or more parties seeking to reach a mutually satisfying agreement. [D04152]	[CSM]
Organization Structure	Identification of participants and their hierarchical relationships. [D01115]	[PMK87]

<table>
<tr><td>Organization Structure</td><td>A structure that defines the reporting relationships, processes, systems and procedures of the project. Issues typically important in the structuring of a project include the degree of project/functional orientation, the extent of the project management (office) authority, collocation of project members, the allocation of resources, work packaging and interface management, and the definition of control, authorization and reporting procedures and systems. There are three basic kinds of organization structure:

1. Functional - where resources are controlled totally from within their respective functional unit

2. Project - where resources are allocated on a dedicated basis to a project, from where they are controlled

3. Matrix - where resources are controlled functionally by their functional head and concerning their project requirements by the project manager

The choice of structure should take account of cultural and environmental influences and may change as the project evolves through the project life cycle and because of different types and conditions of contract. [D03450]</td><td>[CRMP]</td></tr>
<tr><td>Organizational Design</td><td>The design of the most appropriate organization for a project, including definitions of roles and responsibilities of the participants. The five basic kinds of structure are:

1. Functional

2. Coordination

3. Balanced

4. Seconded, and

5. Project Matrix.

[D03880]</td><td>[PNG]</td></tr>
<tr><td>Organizational Learning</td><td>The ability of the organization as a whole to capture knowledge and experience from past projects and apply that to future projects. A relatively new management concept designed to improve the overall performance and responsiveness of an enterprise and avoid the loss of this information when individual personnel leave the enterprise's employment. [D03112]</td><td>[PD-U]</td></tr>
</table>

Performance Measurement	See also Earned Value Analysis. [D03883] Analysis of project progress where the actual money budgeted and spent is compared to the value of the work achieved. [D00582]	[PNG] [WST]
Performance Measurement	A method used to relate physical progress achieved to cost status. The method identifies whether cost variances are due to differences in the value of the work being performed, i.e. too expensive or under budget. From this, it is possible to assess whether a project is ahead, on or behind budget and whether the trend is likely to continue. [D03884]	[PNG]
Performance Measurement Techniques ("PMT")	The methods used to estimate earned value. Different methods are appropriate to different work packages, either due to the nature of the work or to the planned duration of the work package. Another term for Performance Measurement Techniques is Earned Value Methods. [D01167]	[WST]
Performance Reporting	The collection of project performance information and its distribution. [D01168]	[RMW]
Personnel Management	The management of an organization's employee affairs, typically the responsibility of the personnel department. [D03140]	[PD-U]
Personnel Management	An activity encompassing: • Recruiting • Identifying labor and staff skill requirements and availability • Developing training and development requirements • Dealing with workforce disputes, and • Health and welfare issues. [D03451]	[CRMP]
Post-Project Evaluation Review	An important review of project performance and lessons that can be derived from the project conducted once operations have started. Although often considered only after completion of the project, in practice Project Evaluation can and should be a fully integral part of the project. Similar reviews should therefore also be carried out periodically during the course of the project, with the resultant information/lessons fed back into this and other projects. [D03737]	[CRMP]

Post-Project Review	An appraisal of all aspects of a project upon completion, with a view to examining and documenting variations and events, to augment the organization's historical database. [D01225]	[RMH]
Post-Project Review	A formal review of the project that examines the lessons that may be learned and used for the benefit of future projects. [D03889]	[PNG]
Procurement	A process for establishing contractual relationships to accomplish project objectives. The assembly, tendering and award of contracts or commitment documents. Specific procedures should be established for the Procurement Process. [D01264]	[CCCP]
Procurement	All stages involved in the process of acquiring supplies or services, beginning with the determination of a need for supplies of services and ending with contract completion or closeout. [D03548]	[GAT]
Procurement	The act of buying goods and/or services. [D03674]	[DSMC]
Procurement	The process of acquiring new services or products. It covers the financial appraisal of the options available, development of the procurement or acquisition strategy, preparation of contract documentation, selection and acquisition of suppliers, pricing, purchasing, and administration of contracts. It may also extend to storage, logistics, inspection, expediting, transportation, and handling of materials and supplies. It may cover all members of the supply chain. For example, operations and maintenance needs to be supported through a supply chain management process. [D03739]	[CRMP]
Program Management	A management style very different from administrative or corporate management. The objective of program management is to complete a set of projects usually related in some way by a common goal. The life of a program management organization may be quite extended. However, it is characterized by the completion of the projects or tasks under its responsibility, each of which has a clear and finite termination. Program management is terminated when all its projects are completed. See also project management. [D01316]	[CCCP]
Program Management	The effective management of several individual but related projects in order to produce an overall system that works effectively. [D01317]	[WST]
Program Management	The management of a related series of projects executed over a broad period of time, and which are designed to accomplish broad goals, to which the individual projects contribute. [D01318]	[PMK87]

Program Management	The management of a series of related projects designed to accomplish broad goals, to which the individual projects contribute, and typically executed over an extended period of time. [D01319]	[FWH]
Project Appraisal	The discipline of calculating the viability of a project. [D01356]	[WST]
Project Appraisal	The discipline of calculating the viability of a project. Project viability is normally determined in largely economic or financial terms. However, it is normally extended to include issues such as environment appraisal and certainty of performance. [D03910]	[PNG]
Project Close-Out	The full completion of a project signed off by all responsible parties and the finalization of all paperwork. Contractually concluded by a consultant's total performance Certificate. [D01376]	[CCCP]
Project Close-Out	A process that provides for acceptance of the project by the project sponsor, completion of various project records, final revision and issue of documentation to reflect the "as-built" condition and the retention of essential project documentation. See project life cycle. [D01378]	[PMK87]
Project Context	The background or environment in which the project is conducted. Also, the background that justifies the project in the first place. [D03192]	[PD-U]
Project Life Cycle	A collection of project phases whose name and number are determined by the control needs of the organization or organizations involved in the project. [D01428]	[PMK96]

Project Life Cycle	The complete set of time periods through which a project passes sequentially in a logical and orderly manner. In its simplest form the life cycle consists of four major periods: 1. Concept (where the project concept as a need solution is selected and defined) 2. Development or Definition (where the concept is verified and developed into a workable plan for implementation) 3. Implementation (where the implementation plan is carried out); and 4. Close-out (where the project process is completed and documented, and the finished product is transferred to the care, custody and control of the owner.) Progress through the project life cycle is identified by 'milestones', but these major periods should be separated by 'Control Gates' or 'Executive Control Points'. [D01429]	[PMIS]
Project Life Cycle	The four sequential phases in time through which any project passes, namely: Concept; Definition (or Development); Execution (Implementation or Operation); Finishing (Termination or Close Out). Note that these phases may be further broken down into stages depending on the area of project application. [D01430]	[PMK87]
Project Life Cycle	The period from project initiation to completion. [D01431]	[NPMT]
Project Life Cycle	The events, from beginning to end, necessary to complete a project. [D01434]	[WST]
Project Life Cycle	While there are many different versions of the Project Life Cycle, all essentially contain the steps of germination of the idea, proposal and initiation, design and appraisal, mobilization of the team, execution and control, integration of the team and their work, testing, commissioning and handover of the project's product and close-out of the work. [D02626]	[23]

Project Life Cycle	The sequence of phases through which the project will evolve. It is absolutely fundamental to the management of projects, and is the only thing that uniquely distinguishes projects from non-projects. It will significantly effective how the project is structured. The basic life cycle follows a common generic sequence: Opportunity, Design & Development, Production, Hand-over, Post-Project Evaluation. The exact wording varies between industries and organizations. There should be evaluation and approval points between phases often termed 'gates'. [D03748]	[CRMP]
Project Life Cycle	The four sequential major time periods through which any project passes, namely: 1. Concept 2. Definition 3. Execution (implementation or development) 4. Finishing (commissioning or close out). Each period may be identified as a Phase and further broken down into stages that typically reflect the area of project management application and the size and complexity of the specific project. [D01432]	[RMW]
Project Management	An approach used to manage work within constraints of time, cost and performance targets. [D01438]	[WST]
Project Management	May be informally defined as "The art of directing and coordinating human and material resources to achieve stated objectives within limits of time, budget, and stakeholder's satisfaction." Or more formally defined as "The application of modern management techniques and systems to the execution of a project from start to finish, to achieve predetermined objectives of scope, quality, time and cost, to the equal satisfaction of those involved. See also management. [D01439]	[CCCP]
Project Management	The combination of systems, techniques, and people required to complete a project within established goals of time, budget, and quality. [D01440]	[OTOB]
Project Management	The process of directing and coordinating human and material resources throughout the project life cycle using modern management techniques to achieve established objectives of scope, quality, time, cost and stakeholder satisfaction. [D01441]	[PMGdLns]
Project Management	The application of knowledge, skills, tools, and techniques to project activities in order to meet or exceed stakeholder needs and expectations. [D01442]	[PMK96]

Project Management	The art of directing and coordinating human and material resources throughout the life of a project by using modern management techniques to achieve predetermined objectives of scope, quality , time, cost, and participant satisfaction, [D01443]	[PMK87]
Project Management	The art and science of managing a project from inception to closure as evidenced by successful product delivery and transfer. *Editor's Note: See also Change.* [D01444]	[PMIS]
Project Management	The process of reducing project risk and uncertainty to achieve development objectives. [D02620]	[23]
Project Management	The planning, scheduling, and controlling of project activities to achieve performance, cost, and time objectives, for a given scope of work, while using resources efficiently and effectively, [D03618]	[18]
Project Management	The discipline of managing projects successfully. Project management can and should be applied throughout the project lifecycle, from the earliest stages of concept definition into operations & maintenance. It comprises the management of all that is involved in achieving the project objectives safely and within agreed time, cost, technical, quality and other performance criteria. Project management provides the "single point of integrative responsibility" needed to ensure that everything on the project is managed effectively to ensure a successful project deliverable. [D03750]	[CRMP]

Project Management Plan	A baseline tool used as a reference for managing the project. It is the most important document in the overall planning, monitoring, and implementation of a project and should be 'owned' by the project manager and his/her team. The plan should include: • A definition of overall objectives, statements on how these should be achieved (and verified) • Estimates of the time required • The budget • Quality policy • Safety, health and environmental policies, and • The risk management strategy. • Other items of a technical, commercial, organizational, personnel or control nature might also be included. The Project Management Plan establishes project management's interpretation of the why, what, how, who, how much, and when of the project. [D03749]	[CRMP]
Project Organization	A temporary organization created for the purpose of carrying through a project. [D01472]	[NPMT]
Project Organization	The form of organization in which all or nearly all the people working on a project report to the project manager . [D01473]	[SPM 304-9]
Project Organization	The orderly structuring of project participants. [D01474]	[PMK87]
Project Organization	The way the organization is configured structurally. The type of organization in which, and by which, a project is managed should be appropriate to the project's Key Performance Indicators and Critical Success Factors. The form of organization will strongly influence the way project management is to be applied. [D03752]	[CRMP]
Project Organization	The structure, roles and responsibilities of the project team and its interfaces to the outside word. [D03922]	[PNG]

Project Start-up	Activity following the decision to launch project activities. Includes planning, organizing and mobilization of resources. [D01519]	[NPMT]
Project Start-up	The complex sequence of activities that are required to start the project, mobilize the team, initiate the project definition process, obtain agreement to the project's objectives and plan to deliver them. [D02627]	[23]
Project Strategy	A comprehensive definition of how a project will be managed. [D01521]	[WST]
Project Strategy	Projects should have a high level comprehensive definition of the way they are to be developed and managed. All major issues should be addressed i.e. technical, financial, organizational, time and quality as well as safety, human resources, logistics, procurement, information systems and technology. [D03927]	[PNG]
Project Success Criteria	Criteria that should be clearly defined and agreed before significant development is initiated. These may be defined in a number of ways such as: • Business Objectives (or goals) • Requirements, typically technical (performance) requirements • Critical Success Factors, typically measurable factors that, when present in the project's environment, are most conducive to the achievement of a successful project • Key Performance Indicators, typically measures upon which the project will be judged Success Criteria and the manner of their achievement should be documented in the project's strategy plan. [D03756]	[CRMP]
Project Success/Failure Criteria	The criteria by which the success or failure of a project may be assessed. [D01525]	[WST]
Project Success/Failure Criteria	The criteria upon which the relative success or failure of a the project may be judged. Three basic sets of criteria can be identified:	[PNG]
Quality	A trait or characteristic used to measure the degree of excellence of a product or service. [D01558]	[WST]

Quality	Conformance to requirements. A work product either does or does not meet the requirements. [D01559]	[02 10-2] [QMPP]
Quality	The composite of all attributes or characteristics, including performance, of an item or product required to satisfy stated or implied needs. Conformance to requirements. [D01560]	[FWH]
Quality	The composite of all the attributes or characteristics, including performance, of an item or product. [D01561]	[04 4155.11] [QMPP]
Quality	The sum of all attributes or characteristics, including performance, of an item, product or service, required to satisfy stated or implied needs (i.e. conformance to requirements). [D01562]	[PMGdLns]
Quality	The totality of features and characteristics of a product or service that bear on its ability to satisfy stated or implied needs. [D01563]	[ISO 8402] [QMPP]
Quality	The standards and criteria to which the project's products must be delivered for them to perform effectively. First, the product must perform to provide the functionality expected, and to solve the problem, and deliver the benefit and value expected of it. It must also meet other performance requirements, or service levels, such as availability, reliability and maintainability, and have acceptable finish and polish. [D02624]	[23]
Quality	Characteristics that include attributes of usefulness, clarity, reliability, efficiency, cost-effectiveness. [D04206]	[CSM]
Quality Management	The function required to determine and implement quality policy throughout the project life cycle. Quality management encompasses the sub-functions of Quality Assurance and Quality Control. [D01589]	[FWH]
Quality Management	That aspect of the overall management function that determines and implements the quality policy. [D01590]	[ISO 8402] [QMPP]
Requirements Management	The process of exercising some control over the project scope to avoid scope creep, based on stakeholder needs rather than nice-to-haves. [D03238]	[PD-U]
Requirements Management	The process of defining the user/customer requirements and building the system requirements before going on to develop the performance specifications in detail. Requirements should be comprehensive and clear, well structured, traceable and testable. They should give rise to clearly specified project deliverables and should be tested against the original set of requirements. Any changes to the initial requirements should be traceable i.e. documented and explainable. [D03762]	[CRMP]

Resource Management	The planning, allocating and scheduling of resources to tasks, generally including manpower, machine (plant and equipment), money, and materials. Resource Management typically covers resource allocation and its impact on schedules and budgets, as well as resource leveling and smoothing. [D03763]	[CRMP]
Resource Planning	Evaluating what resources are needed to complete a project and determining the quantity needed. [D01680]	[WST]
Resource Planning	The selection of resources in type and quantity required to complete a project. [D01681]	[RMW]
Risk Management	An organized assessment and control of project risks. [D01682]	[PD-U]
Risk Management	The process of identifying, analyzing and responding to risk events throughout the project life cycle in a manner that is in the best interests of the project's objectives and its success indicators. [D01718]	[PMGdLns]
Risk Management	Organized control of risks. [D01734]	[NPMT]
Risk Management	The art and science of identifying, analyzing and responding to risk factors throughout the life of a project and in the best interests of its objectives. [D01735]	[PMK87]
Risk Management	The overall process of managing risk including risk identification, risk analysis, risk reduction, risk transfer, risk avoidance and contingency planning. [D03939]	[PNG]
Safety	The condition of being safe from undergoing or causing hurt, injury, or loss. Protection against failure, breakage, or accident. [D03251]	[Webster]
Sales	1. A department responsible for selling 2. The collective amount sold, typically in a given period. [D02993]	[PD-U]
Schedule Control	Controlling schedule changes. [D01777]	[WST]
Strategy	A careful plan or method focused on macro goals. Completed, fulfilled and sometimes exceeded with the aid of tough-minded tactics – micro-focused action steps. [D01924]	[TML 222]
Strategy	A framework guiding those choices that determine the nature and direction to attain the objective. [D01925]	[PMK87]

Success, project	The achievement of stakeholder satisfaction. [D01944]	[RMH]
Successful Project	A project is successful when: 1. The objectives of the project have been achieved to the full satisfaction of the users, 2. All closeout activities have been completed, and 3. All designated interests, including the project's sponsor and/or initiator officially accept the project results or products and close the project. [D03790]	[SU]
Systems Management	Management that includes the prime activities of systems analysis, systems design and engineering and systems development. [D01979]	[WST]
Systems Management	The elaboration of the specification for the technical, organizational, cost, time and other parameters of a system and the subsequent management of the planning, design/engineering, procurement, implementation and testing areas of the work needed to realize the system concept. Systems management comprises the prime activities of systems analysis, systems design and engineering and systems development. *Editor's Note: 'development' in this context means the implementation of the design and engineering.* [D03959]	[PNG]
Teamwork	Work done by several associates with each doing a part but all subordinating personal prominence to the efficiency of the whole. [D03330]	[Webster]
Teamwork	Joint action by a group of people, in which individual interests are subordinated to group unity and efficiency. A coordinated effort. [D03331]	[PMDT]
Testing	That element of inspection that determines the properties or elements, including functional operation of supplies or their components, by the application of established scientific principles and procedures. [D02028]	[FAR 46.101] [QMPP]
Value Management	A structured means of improving business effectiveness that includes the use of management techniques such as value engineering and value analysis. [D02110]	[WST]
Value Management	A technique for optimizing cost and/or performance. [D02111]	[CCCP]

Value Management	This technique is a creative, organized approach designed to optimize the total cost and/or performance of the project. Usually applied only to the most significant elements of a project by analyzing their contribution and identifying functionally acceptable substitution. VM often results in improved performance and/or appearance and simplification at a payoff many times the cost of the VM program. It is best applied in the earliest stages of a project. VM is not popular because of its "real" front end cost compared to "notional" downstream savings. Also because it is seen by designers as a threat to their credibility. See also Brainstorming. [D03094]	[CCCP]
Value Management	An organized effort aimed at analyzing the function of a system or systems, equipment, facilities, and supplies, for purposes of achieving at the lowest overall cost the same required function and/or performance, including reliability, maintainability, delivery and human factors. [D03625]	[SU]
Value Management	A structured means of improving effectiveness in line with the organization's goals. It refers to the overall process of identifying key issues and setting targets; identifying the teams and processes necessary to achieve these; and implementing these to obtain successful results. It is concerned with the broader optimization of strategic issues, encompasses the value engineering process at the project's strategic definition stage and is generally done via a structured workshop. [D03775]	[CRMP]

Table 6 – Constructs Reflecting the Nature of Projects (From Nvivo)

	Technical	People	Proportion of references			
Project-related constructs	1		1	1%	1	1%
The change to be accomplished		1				
Implementing business strategy	7	1	16	14%		
Allocating resources	6	1				
Benefits-related items					23	20%
The Auditing benefits achievement	2	2				
Defining the benefits	2		7	6%		
Harvesting the benefits	1					
People involved in the project	1	2				
Stakeholder management	6	6	25	21%	25	21%
Temporary teams	3	7				
Nature of the particular project	3		3	3%		
Project goals	1					
Defining project goals	2					
Aligning people behind goals	3	3	14	12%		
Assuring feasibility of goals	1					
Auditing achievement	3	1				
The product/service to be delivered	2					
Defining the product	1					
Delivering the product	5		16	14%		
Making the product	3	1			62	53%
Managing the quality of the product	4					
Managing the work to be done	3					
Avoiding rework	2					
Doing the right work	4	1	19	16%		
Doing the work efficiently	4	3				
Managing inter-depencies	2					
Coping with inherent uncertainty	2					
Predicting the future	7	1	10	9%		
Reacting to circumstances						
Stages in the project's existence	5	1	6	5%	6	5%
	86	31	117	100%	117	100%

Detailed analysis behind Table 6 – Classification of Constructs Comprising the Project Manager's WorldView

General

1. Project Management

The Change to be accomplished through the project

Technical topics: Implementing Business Strategy

Business Case

Management by Projects

Marketing

Program Management

Project Strategy

Sales

Strategy

Success, project

Technical topics: Allocating resources

Finance

Organizational Design

Program Management

Project Appraisal

Resource Management

Resource Planning

People Topics – General

Managing Change

People Topics – Implementing Business Strategy

Post-Project Evaluation Review

People Topics – Allocating Resources

Organization Structure

BENEFITS

Technical topics: Auditing Benefits

Project Success/Failure Criteria

Success, project

Technical topics: Defining the Benefits

Business Case

Program Management

Project Appraisal

Technical topics: Harvesting the Benefits

Value Management

People Topics – Auditing Benefits
Organizational Learning

Post-Project Evaluation Review

People Involved in the Project

Technical topics: General
Information Management

Technical topics: Stakeholder Management
Communication

Contract Administration

Legal Awareness

Organizational Design

Procurement

Success, project

Technical topics: Temporary Teams
Integration (1)

Organizational Design

Safety

People topics: General
Culture

Industrial Relations

People topics: Stakeholder Management
Communication

Conflict Management

Integration (2)

Managing Change

Negotiation

Organization Structure

People topics: Temporary Teams
Conflict Management

Integration (1)

Leadership

Organization Structure

Personnel Management

Project Organization

Teamwork

The Nature of the Particular Project

Technical topics: General
Design

Information Management

Project Strategy

PROJECT GOALS

Technical topics: General
Cost

Technical topics: Defining Project Goals
Project Success/Failure Criteria

Value Management

Technical topics: Aligning People behind Goals
Integration (1)

Project Start-up

Resource Planning

Technical topics: Assuring Feasibility of Goals
Project Management Plan

Technical topics: Auditing Achievement of Goals
Cost

Performance Measurement

Performance Measurement Techniques ("PMT")

People topics: Aligning People behind Goals
Conflict Management

Integration (1)

Leadership

People topics: Auditing Achievement of Goals
Post-Project Evaluation Review

THE PRODUCT/SERVICE TO BE DELIVERED

Technical topics: General
Legal Awareness

Systems Management

Technical topics: Defining the Product
Requirements Management

Technical topics: Delivering the Product
Financial Management

Hand-Over

Procurement

Project Close-Out

Project Management Plan

Technical topics: Making the Product
Integration (1)

Schedule Control

Value Management

Technical topics: Managing the Quality of the Product
Integration (1)

Quality

Quality Management

Testing

People topics: Making the Product and Managing it's Quality
Integration (1)

MANAGING THE WORK TO BE DONE

Technical topics: General

Change Control

Estimating

Project Management Plan

Technical topics: Avoiding Rework

Configuration Management ("CM")

Risk Management

Technical topics: Doing the Right Work

Contract Administration

Integration (1)

Procurement

Requirements Management

Technical topics: Doing the Work Efficiently

Integration (1)

Procurement

Resource Management

Safety

Technical topics: Managing Inter-dependencies

Configuration Management ("CM")

Schedule Control

People topics: Doing the Right Work

Integration (1)

People topics: Doing the Work Efficiently

Conflict Management

Integration (1)

Teamwork

COPING WITH INHERENT UNCERTAINTY

Technical topics: General
Change Management

Risk Management

Technical topics: Predicting the Future
The process of implementing procedures which ensure that proposed changes are properly assessed and, if approved, incorporated into the project plan. Uncontrolled changes are one of the most common causes of delay and failure. (Change management 2)

Estimating

Performance Measurement

Performance Measurement Techniques ("PMT")

Project Management Plan

Resource Planning

Schedule Control

People topics: Predicting the Future
Organizational Learning

Stages in the Project's Existence

Technical topics:
Close-out

Hand-Over

Project Close-Out

Project Life Cycle

Project Start-up

People topics:
Integration (2)

Appendix P-2

Details of "Bodies of Knowledge" Workshops

1. International Research Group: Project Management Workshop

NASA, Virginia Beach. 11 & 12 June 1999

Outcomes and Agenda

Outcomes

By the end of the two day meeting, the group of assembled distinguished project management researchers and experts hope to have:-

1. A list of the basic concepts, drawn as widely as is practicable, that could be reasonably claimed to form the global body of project management knowledge. This is likely to take the form of a long list of words, together with a description of the concepts that they represent.
2. A number of alternative structures, applicable in different ways and in different areas, that represent legitimate ways of structuring the body of knowledge and breaking it down into its components.
3. A clear programme of action that will develop the ideas from the workshop and complete the work started in the two days.

All attendees are committed to the open availability of this work to academics and practitioners throughout the world.

Meeting Agenda

Friday 11th June

0900	Introductions, outcomes from the workshop, and ground-rules for the discussions.
1045	Break
1115	Validation of basic concepts as pre-prepared by steering committee. Groups and plenary session

	to work through all the 500 or so concepts, agree all that can be agreed, and place all disputed terms into a “car park” for later.
1230	Lunch break
1330	Validation (continued). The end of this session should deliver outcome #1 above.
1530	Break
1600	Seeking to apply structure. Using the “Metaplan” adhesive panels all round the room (see attached room layout diagram), delegates begin to apply structure to the concepts by “trial and error”. Secretarial help will be appreciated to transcribe ephemeral structures as they appear, before they disappear.
1800	Close of Day 1 Evening left free for informal networking.

Saturday 12th June

0900	Structure session part 2. Continuation of the session that commenced on the previous afternoon. It is anticipated that alternative structures will be explored and documented. Secretarial help will once more be appreciated.
1045	Break
1115	Evaluation of the alternative structures. Using some electronic decision support software (such as ECPro) that incorporates the Analytic Hierarchical Process, the group reaches a collective evaluation of the strengths and weaknesses of the alternate structures developed during the previous two sessions. The end of this session should deliver outcome #2 above.
1300	Lunch break
1400	Planning for future work. The group takes the output from the previous sessions, and develops a list of future activities along with due dates and the names of those responsible.
1600	Workshop close

Intention

This working meeting is intended to be a creative and unbiased session using open and innovative approaches to consider the complete diversity that the evolution of PM has passed through in the various cultures world-wide. Apart from all kinds of secondary interest, the participants are invited to contribute and to structure afresh the maximum PM knowledge that is accepted world-wide as well as to minimise restrictions in individual or local application. The outcome is intended to reflect the global PM and to serve the professionalisation of PM as a discipline.

Terry Cooke-Davies
7th March 1999.

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2. Towards a global body of project management knowledge

June 18-21 2000[1]

Aim for OLC June 2000

The aim remains the same as it was for OLC June 1999 – to work towards agreement on a global body of project management knowledge.

Draft Agenda for OLC June 2000

Building on the results achieved in June 1999 and subsequently, and consistent with the proposed Action Item List (pp. 40-41 of Report of June 1999 Workshop – www.aipm.com/OLC/) and recent email feedback from participants; the following agenda items are proposed:

- **Brief Glossary Review:** briefly review Max Wideman's Glossary and any issues of national / cultural interpretation
- **Structuring the body of PM knowledge:** consider and develop ways of structuring a globally accepted body of PM knowledge
- **Action Plan:** Develop framework and plan for further action

Draft Programme

A draft programme, following the above agenda plus the initial programme suggested by Jon Erik Hogberg of Telenor, is attached.

Review of Action Item List for the next 12 Months

This list has been taken from the list of this name on page 40 - 41 of the June 1999 Workshop Report. Please refer to that initial list for further detail and views expressed at that time. This list is intended to provide continuity but highlight the direction and aims for June 2000.

From the following, and from email comments received from participants, it seems that the aims for the June 2000 workshop should address:

1. **Complete the list of terms with definitions**
   - See Glossary developed by Max Wideman (http://www.pmforum.org)
2. **Common understanding of PM definitions amongst national associations / nations**
   - This should follow on the basis of the Max Wideman Glossary
   - Suggest that one representative of each National Association take responsibility for doing this – and ideally reporting any issues of disparity in understanding at or before the June Workshop, or as a longer term activity. From the list of those who expressed interest in this:

     Olaf Pannenbaecker (Germany)
     Bruce Rodrigues (South Africa)
     Paul Dinsmore (South America)
     Rodney Turner / Peter Morris (UK)
     Sergei Busheyev (Ukraine)
     Christophe Bredillet (France)
3. **Structuring the body of PM knowledge –(A mini-atlas: more than one map plus definitions)**

This was begun in Virginia Beach and is the main area of interest expressed by the group in preparing for the June 2000 workshop.

Agreeing the overall area included in a PM body of knowledge has proven less difficult than agreeing on how it should be structured. The suggestion that there should not be a single structure seems to be widely accepted by the group.

The issue of knowledge classification structures is not confined to project management and is one of the fundamental issues of knowledge management. We are not alone in finding this difficult. This makes it even more interesting and challenging.

In fact, this presents an exciting opportunity to take a new approach and develop a global body of PM knowledge with an open structure following the concept of open systems. The output may not be a single publication with one structure, or even a number of publications based on different structures, but an interactive database that allows the user to structure the knowledge according to their specific needs or world view. The Internet makes this possible.

This approach would satisfy the majority of comments made on this issue in Virginia Beach.

4. Publish several articles in international journals based on the work accomplished to provide visibility

- More needs to be done in this area.

5. Identification of concepts applicable to managing projects of a generically different nature

This idea should not be lost and should be raised again in June 2000 but appears premature at this stage.

6. A report describing progress and pointer to Website with complete details --Computer Infrastructure

- Done

7. A recognized Charter for this group with a sustainable funding source

The future of the group needs to be considered at the June 2000 workshop.

8. Global consideration, perspective of multiple views of project management standards and knowledge. Not one way, but agreed upon and supported different ways. (Adesh)

- See Item 3 above

Draft Workshop Programme

Date	Time	Activity
Sunday 18.06.00 Venue place: "Little Maritime"	1900 1930 2100	Latest arrival and check-in at Rica Villa Maritime Hotel, Haugesund (Ground rules : hotel and all meals sponsored by Telenor, other related costs like airplane tickets, phone, barbills, etc to be covered by delegates,) Official opening of workshop at "Little Maritime" Welcome to Norway and Telenor: Jon Erik Høgberg (15 min) **Welcome to Haugesund by the Mayor of the city, 30 min incl Virtual sightseeing of surroundings** Workshop theme and aims: Lynn Crawford (30 min) Dinner, sponsored by Telenor
Monday 19.06.00 Venue place: Conference room in Hotel	0800-0845 0845-0930 0930-1030 1030-1045 1045-1230 1230-1330 1330-1530 1530-1600 1600-1730 1800	**Session 1**: Introduction to workshop facilities; review of activities since Norfolk / Virginia Beach Presentation by Vice Pres.Gunn Bente Johansen, Telenor **Session 2**: Expectations; Agree workshop program; Ground rules; Coffee/tea morning break **Session 3**: Brief Glossary Review **Session 4:** Knowledge classification structures: discussion,; implications; criteria for evaluation. Lunch at Gallionen **Session 5:** Knowledge structures: working session Afternoon coffee/tea break **Session 6:** Knowledge structures: report back Dinner and Social event of the day; Sponsored by Telenor, Bring warm jacket/sweater
Tuesday 20.06.00 Venue place: Conference room in Hotel	0830-0900 0900-1030 1030-1045 1045-1200 1200-1330 1330-1530 1530-1600 1600-1730 1930	**Session 7:** Good morning and reflections on yesterday **Session 8: Knowledge Structures: plan further action** Coffee/tea morning break **Session 9:** Framework and plan for future action Lunch at Gallionen + spare time **Session 10:** challenges for project management **Session 11**: discussion on Telenor specific challenges Afternoon coffee/tea break **Session 12:** recommendations to Telenor on challenges Dinner and Social event of the day; Sponsored by Telenor
Wednesday 21.06.00 Venue place: "Little Maritime"	0800-0930 0930-1000	**Final Session:** Good morning and reflections on yesterday Key results, findings and further steps Key recommendations to Telenor and proposed actions **Closing Session:** Closing, wrap up, did we meet expectations ? Farewell and off to PMI in Paris

[1] This agenda was prepared by Lynn Crawford, with input from the steering group, which included the author of this thesis, Terry Cooke-Davies.

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Appendix P-3

Development of the Data Collection Instrument

Project Initiation Document (Draft A)

Data Collection Tool for a Database of Projects Mk. 2

Background.

The Management Boards of both Europe 1 and Europe 2 have decided that it is important to create a modified data collection tool for the Project-level Database for three reasons:-

1. Members of Europe 1 chose a modified data collection tool as one of their preferred topics for work during Cycle 3 of their activities.
2. The joint workshop of both Europe 1 and Europe 2 emphasised the need for a modified data collection tool in order to encourage data collection, and build up the project-level data resource as quickly as possible.
3. Work done at Workshop 4 of Cycle 3 (Europe 1) indicated that three improvements are needed:-
   a) Greater ease of data collection by network members
   b) Greater confidence in the integrity of data provided to the Network's project-level database.
   c) Improved cost/benefit of using the tool, both to member organisations and to the project manager who provides the data.

A working party of volunteers from both networks has been assembled to manage the production of the data collection instrument.

Project Definition

Purpose of the Project

The project has been established for the purpose of creating an improved data collection tool that will be available to all members of Europe 1 and Europe 2, and members of other benchmarking networks as agreed by the management boards. The sole deliverable will be a new data collection tool.

The concept of the new Data Collection Tool

The new collection tool will consist of the following elements.

1. A list of defined points at which the tool may be used to record status and to capture information. Initially referred to as the "**Context**", this part of the tool will be a set of clearly defined milestones, points in time, or "states". These will capture the whole value chain, and will be applicable from the perspectives of procurers, suppliers, prime contractors or totally in-company projects. The points chosen will avoid implying any preference for a serial life-cycle or for massively parallel development.
2. A questionnaire to capture project management practices on the project and used at the specific points defined in the "context". Initially called the "**footprint**" because it will print a radar-chart "footprint" of project management practices in use, this part of the data collection tool will be based on a simple "Point and Click" electronic questionnaire that will aim for 20 to 30 minutes time to complete. The output should imply corrective action at each stage of use, and should transmit its output ins some form into the project "log" (see below). The "footprint" will provide the "best practice" data to the project-level database.
3. A database of numbers, events and documents that provides the quantitative data for the project-level database, initially referred to as the project "**log**". The envisaged format is an Access Database containing templates for recording key occurrences, forms for input, reports for output and prompt lists to assist project managers in knowing what to record. The database

should cross-relate to the "context", and includes "footprints" when they are run. The whole "log" should be customisable by individual network members to suit their own internal purposes, while including as a minimum a common core of data that can be exported to the Network's database.

Purpose of the new Data Collection Tool

The tool exists to provide the following benefits:-

For the Network

- A tool which has clarity about what is meant by each question.
- Data which is consistent with the overarching data set and which has an effective labelling system (assigning projects to data types)

For individual network members

- A tool which is user-friendly, on standard software and can be run over LANs. We need to encourage the PM to enter data - there must be a positive incentive to data entry for organisations as well as for project managers. To gain clarity about what we mean by each question. Keep it simple!
- Data which possibly links milestones to processes and answers such questions as:-

  How much is it costing to manage the project?
  Should we continue with this project?
  Are we getting better at managing projects?
  What practices have the biggest impact on how well we do?
  What should we do more of?
  What is the benefit value of a project compared with its cost?
  Did we really do what we set out to do (post-implementation, 6 months out)?
  What benefits can we expect from what practices?
  What life-cycle patterns of e.g. Risks Retained correlate to what project results?

For the project managers who are providing the data:

- A tool which:-

  provides a road map to project managers as to when they provide the data;
  is user-friendly, on standard software and can be run over LANs;
  gives the provider of data real and immediate benefits (project close-out report, corrective action etc.);
  puts some "expert system" warnings at certain stages,
  incorporates best practice findings into the footprint;
  gives clarity about what we mean by each question, and
  keeps it simple.

- Data which tells the project manager

  How much it is costing to manage the project?
  Whether we have done all the things we should have done by this stage?
  How we are doing against baselines: time, cost, spec?
  Whether we are getting better during the project.
  What is the optimum value you get for the time you spend?
  Did we really do what we set out to do (post-implementation, 6 months out)?

Project Organisation

Roles within the project were assigned as follows

Steering Group = Working Party

Project Manager = TCD

Resources: Statistical data analysis - POCL Research Services

IT Resources - BT

Work Package managers and resources: Working party Members

How we will work together

The main approach to managing the project will be as follows:-

- All-day workshops (10 to 4.30)

- Workshops where people propose way ahead and present work done to date.

  Aim to get a great deal of work done by Metaplan methods at each workshop.

- Small workshops with round robins and data gathering from other members as input.

- Buddy system.

Buddies

- BT - Nortel
- Mercury - BB, Anglian Water
- POCL - ICL
- HSL - NatWest
- Thames - Glaxo-Wellcome
- Nationwide, BP to be paired with Lloyds TSB & MMS
- LUL - Kvaerner John Brown
- Perkin-Elmer - Bull
- SB - GEC Marconi Avionics

High-Level Work Breakdown Structure

Data Methodology (TCD, SB, LUL)
Context (LUL, POCL)
Footprint (Mercury, All members)
Log (POCL, All members)
Database (BT)
Testing & Piloting (POCL, LUL, TWL)

Project Management (HSL)

Acceptance criteria

1. The product will be accepted at the close-out if it provides a tool that:-

   a) Network members agree to use to provide additional project data.

   b) Can be implemented with no training beyond the meeting at which it is launched, and only minimal telephone support.
   c) Contains data that can be validated.
   d) Meets the three improvement objectives.

2. In the longer term, the new tool will be successful if:-
   a) The project-level database continually grows.
   b) The data collection tool is so good that people come knocking on the door to use it.
   c) The clients (internal or external) for the projects carried out by member organisations insist that their project managers use the data collection tool.

Project Schedule

See attached Microsoft project Gantt chart, containing the work as so far defined.

Terry Cooke-Davies, May 12, 1997

Appendix P-4

Goals and Questions for the Data Collection Instrument Mk.2

Goals of the data collection study

G1. To indicate corrective action that should be taken during the life of a project.

G2. To provide a periodic, independent audit of the conduct of the project.

G3. To identify which practices contribute to success, and the optimum profile or weighting between them.

G4. To identify externally mandated practices that inhibit project performance.

G5. To examine whether specific practices are better done at specific times in the life of a project.

G6. To identify the extent of improvements in project performance.

G7. To provide data to an external database (held by the Network) in a comparable and useful format.

Questions of interest to support the goals

Q1 What does “Best Practice” look like at this point in the life of a project? (G1)

Q2 What are the current variations from best practice?

Q3 What are the implications of each variation?
- a) Risk
- b) Criticality
- c) Cost/benefit

Q4 What options exist to take corrective action?
- a) Risk
- b) Criticality
- c) Cost/benefit

Q5 Where do we think we are in the project?

Q6 What sort of project is it (project category)? (G2)

Q7 Do documents exist that define what the project deliverables are?
- a) Are they being maintained as live documents?

Q8 Have the project manager/project team developed their competencies during the course of the project?

Q9 Is the project organisation structure defined?
- a) Does it contain all key stakeholders; client, customer, supplier, project management team etc.?
- b) Does everyone who is part of the project know that they are?
- c) How extensive have personnel changes been?

Q10 Do project members have sight of and access to project requirements/objectives?

Q11 Have all necessary authorities been obtained?

Q12 Has the project justification (business case) been validated?

Q13 Are the resource needs understood?
- a) Are the required resources available?
- b) Are the resources booked?

Q14 Are the project management processes defined?
- a) Are the processes being followed?

Q15 Have all the products that should have been delivered, been delivered?

Q16 Are costs being controlled effectively?

Q17 Is schedule being controlled effectively?

Q18 What are the practices that are being used? (G3)
- a) How much time and resource is put into each practice?

Q19 What skills mix have we used for the specific processes?

Q20 How much does it cost to run the project?

Q21 How successfully are we delivering the project's functions?

Q22 What externally mandated practices are being followed on the project? (G4)
- a) How much time and resource is put into these practices?
- b) Who is mandating that these practices are followed on this project?
  - i) Customer
  - ii) Regulator
  - iii) Enterprise

Q23 What practices are being followed that are not required (e.g. add no value) for the success of this project?
- a) How much time and resource is put into these practices?
- b) Who is mandating that these practices are followed on this project?
  - i) Customer
  - ii) Regulator
  - iii) Enterprise

Q24 What corrective action have we taken since last using this tool? (G6)

Q25 How do the implications of variations compare with the last time we used the tool?

Q26 What environmental factors external to the project have influenced project performance?
- a) What influence have they had?

Q27 What are the data standards governing answers to the questions 1 to 26? (G7)

Appendix P-5

Questions in Corporate Practice Questionnaire (CPQ) Version 3

01. Integrating project working into the organisation.

a) Extent of project working

1 Does the organisation recognise projects as a valid way of working?

4 To what extent are project management practices brought to bear when implementing change programmes?

5 How is the Project Office concept used to support change in the organisation?

7 How many levels of hierarchy are involved in financial, resourcing, and scheduling decisions?

12 Are there structured in-house learning opportunities for all staff giving them access to basic project knowledge?

b) Integration of projects

2 Are projects run as autonomous units, or as an integral part of the business or are they lumped together for convenience (of the management)?

3 How are projects aligned with the business cycle?

6 Is the concept of Programme Management used to control linked projects and co-ordinate the deliverables?

8 What are the terms of reference and authorisation levels of project managers?

9 Is Portfolio Management used at the strategic level to control the strategic deliverables of the organisation?

10 Does the planning process integrate business and project planning?

11 What process is used to reconcile project estimates with corporate budgets?

c) Implementing process improvement

13 What mechanisms are in place to facilitate the spread of best practice through the organisation?

14 Is innovation encouraged?

15 Does a process improvement process exist?

16 Is there a process review process?

17 Does a budget exist for developing new processes?

02. Managing human factors in projects.

a) Organizational culture

18 Is there a stable, well defined project culture?

19 Does the organisation encourage open communication of project results?

20 Are mistakes tolerated if lessons are learned and processes improved?

21 Where are the project managers and project team members drawn from?

22 To what extent is support to projects available from a central project office?

b) The project management community

23 Is the role of the project manager clearly defined, and understood, within the organisation structure?

24 Are project managers selected and assessed against a defined set of competencies?

25 Does the organisation require some formal qualification?

26 Are project managers encouraged to acquire a formal qualification?

27 Is there a defined project management career path, supported by a training programme?

28 How are project people appraised?

29 How is their career path managed?

30 Is project working recognised as an important area of experience?

31 What special actions are taken to train and support Project Managers?

32 What documentation, examples, support and training are available to underpin the way in which the organization runs its projects?

33 Does the organisation provide training and support in risk analysis and management?

34 What is done to enhance motivation and teamwork?

c) Project teams

35 What management strategy exists?

36 Are project managers selected for a particular style of management?

37 What factors influence the style used in your organisation?

38 How are resources allocated and conflicts resolved?

39 How are the people associated with the project?

40 How are projects staffed?

41 How are project teams constructed?

42 How are project people given due recognition?

43 What training is provided - for the project, for projects in general, for the company and for the individual's career path?

03. Defining project "anatomy".

a) Project life cycle

44 Is there a defined project life cycle?

b) Project organisation

45 Is there a standard project organisation?

c) Project methodology

46 Is there a defined project methodology?

47 Is there a formal process for the design and release of work packages to work package managers?

48 Is milestone reporting used to monitor progress?

49 Is client acceptance documented at the completion of each stage as appropriate?

50 Is each deliverable from a project defined in terms of the requirements being satisfied by that deliverable?

51 Are common terminology and language used across the project organisation?

d) Special situations

52 Is there a specific way of handling multi-team, multi-national projects?

53 How are technology driven projects incorporated into the business?

54 When dealing with R&D projects is a route established to capture the

requirements of the end user?

55 Is there a defined strategy, and supporting processes, for the bidding phase?

56 To what extent do regulatory authorities affect the way in which projects are run?

04. Measuring project performance.

a) Project metrics

57 What practical project metrics does the organisation keep and how are they used?

b) Benefits management

58 What investment management processes exist?

59 How are the benefits of a project assessed?

c) Performance measurement

60 Are project performance measures collated and used?

05. Defining and executing projects.

a) Perspectives and relationships

61 What use is made of the insights gained from an explicit use of defined Project Manager perspectives?

62 How are specific relationship models built into the structure of the project?

b) Strategy

63 What is the project strategy? How is it defined?

64 Does the organisation have a contracts strategy?

c) Procurement

65 What procurement methods and processes are employed?

66 How are suppliers selected?

d) Project start-up

67 How does a project actually start?

68 How is the project manager first involved in the project?

69 How are people applied to the project in its early stages?

e) Customer management

70 Is there a defined procedure for dealing with new customers?

71 Who controls the customer interface?

72 How are customers/clients involved in a project?

73 Is an effort made to understand and manage the customers' expectations?

74 Does a change management process exist which is customer oriented?

75 What IT systems are in place to support project implementation?

f) Systems management

76 How much input does the project management community have in the definition of new IT systems for project management?

06. Closing Projects

a) Close-out activities

77 Is there a defined process for demonstrating completion of the project and for the subsequent hand-over to the customer?

78 How is completion of the work defined?

79 Does a project closedown process exist?

80 Is there an archiving policy?

81 What documentation has to be completed before the project can be closed?

82 Do all projects hold post-project reviews to capture any relevant project information?

b) Recording lessons learned

83 How does the organisation learn from experience?

84 Are risks and outcomes reviewed in project reviews and any lessons fed back?

85 Are lessons learned from schedule control accurately recorded?

86 Are the effects of rework on cost and schedule properly recorded?

07. Project Planning

a) General planning approach

87 Is there a nominated planning methodology available to all project managers?

88 Does the planning process recognise that more detail is required on activities to be performed in the short term?

89 Is there a conscious decision to balance the effort in planning against the value for money?

b) Detailed planning

90 Is the scope defined by the Work Breakdown Structure (WBS) used to define activities?

91 What methods are used to focus on the time-critical aspects of projects?

92 Does resource planning concentrate on the resource-critical aspects of projects and relate that to the overall resource availability?

93 Is a specific method of budgeting related to project cost used?

08. Estimating cost, time and resource requirements.

a) Requirements

94 Does the organisation pay particular attention to the accurate definition of the customer's requirements?

b) Relationship to project planning

95 Are projects adequately planned before estimates are required?

c) Principles and concepts

96 Does senior management have a consistent understanding of the type of estimate they are being asked to consider?

97 How is allowance made for new technology and techniques to be used for the first time on a project?

98 How is the estimating process modified to cater for the use of sub-contractors and/or the involvement with a consortium?

99 Are structured labour rates, which include indirect costs, used as the basis for cost estimates?

d) Estimating processes

100 Is a well understood, comprehensive estimating process used for all projects?

101 Are activity estimates generated in consultation with the people who will be doing the work?

102 Are estimates (time, cost and resource) produced to standard ranges of accuracy at specific points in the project life cycle?

e) Tools to support estimating

103 What tools are available to support the estimating process?

f) Access to prior experience

104 How are previous experience and metrics used to improve the estimating?

g) Estimating the impact of project changes

105 Is there a proven process for estimating the effect of changes to the requirements?

09. Analysing and managing risk.

a) Risk identification

106 Is there a formal process for identifying and quantifying risks?

b) Risk assessment/analysis

107 Does the organisation have a formal risk analysis process in place?

108 How are the technical risks evaluated?

109 Is risk assessment and management seen as part of good project management practice?

c) Risk management

110 How is risk management applied?

d) Risk response control

111 How are individual risks managed?

10. Monitoring and controlling progress.

a) Integration

112 How far is integration seen as a key factor in managing projects of all sizes?

b) Tools and techniques for monitoring progress

113 What project management systems are employed?

114 Is the technique of managing by exception used?

115 What progress monitoring tools are used?

c) Baseline management

116 Is baseline management used?

117 Are effective change management processes in place to ensure the integrity of the baselines?

d) Contract management

118 Is contract management part of the project manager's brief?

e) Control

119 Does a "benefit" monitoring process exist which is used throughout the project life cycle?

120 Are progress reviews carried out on the basis of forecasts to completion rather than work done?

121 Are there any special techniques for managing costs?

122 Are there any special techniques for managing time?

123 Are there any special techniques for managing resources?

124 What use is made of Earned Value as a practical tool to support project reviews?

f) Communication

125 Is there a formal communication plan for the project and the organisation?

126 Is there a process for keeping stakeholders informed of project status?

127 Do meetings of the Project Control Board, and other project reviews,

result in agreed actions that are constantly monitored?

128 Is information concerning risks fed to the project team as the risks are identified, managed and expired?

11. Managing quality.

a) Total Quality Management

129 Does the organisation have a Total Quality Management programme that covers projects?

b) Quality management processes

130 Are the quality management processes defined and used?

131 How are the customer's requirements for quality in process and product accommodated?

132 Is there a Quality Assurance process that ensures actions are taken to increase the effectiveness and efficiency of projects?

133 What quality standards are employed by the organisation?

134 What audits does the organisation operate?

135 Does the quality audit process define how lessons learned should be incorporated in improved processes for the benefit of other projects?

c) Change control

136 What change management processes are used?

137 Is there a process for continuously refining the requirements of the "product" to be delivered by a project?

d) Value management

138 Is value management considered to be an integral part of the project process?

e) Configuration management

139 What configuration management processes are used to ensure that a consistent set of deliverables is produced?

12. Overall results analysis.

140 How do customers view the conduct of their projects?

141 How does the organisation view the conduct of its projects?

142 How do the people on the projects view their role and prospects?

Appendix P-6

Questions on "Project Management Practices" in DCI Version 3.

No.	Question	Type
P1	Are there check lists of risks appropriate to the project?	Process
P2	Is there company-wide education on risk concepts?	Product
P3	Is there a process for selecting PMs include both needs and individual competencies?	Process
P4	Is a recognised & efficient startup process used?	Process
2	Is there a formal process for identifying and quantifying risks?	Product
3	Is there a process for selecting key risks based on probability and impact?	Process
4	Is there a formal process for developing and controlling responses to risk?	Process
5	Have all risks that are to be managed had owners assigned?	Process
6	Is there a visible risk register showing the impact & probability of each risk, and other information?	Product
7	Is the risk management plan up to date?	Product
8	Do risk owners take personal responsibility for their risks?	Product
9	Do plans and budgets include costs and time from risk analysis?	Process
10	Do those who will be affected by risk (including the PM) take the decisions about containment or contingency?	Product
11	Do senior management / client recognise that there is risk associated with the project?	Product
12	Is information about risks communicated to the project team throughout the life of the project?	Product
13	Are risks reviewed in project reviews, and lessons fed back?	Process
15	Has the benefit / value been monitored throughout the life of this project?	Process
16	Have stakeholders been notified, as appropriate, of cost / schedule information?	Process
17	Has a system been used to provide the right level of information at the right level of authority?	Process
18	Has the project used project management tools that are integrated?	Product
19	Has the project been reviewed on the basis of forecast to completion rather than on work done?	Product
20	Has Earned Value Analysis been used as a practical tool to support project reviews?	Process
21	Have lessons learned from schedule control on this project been documented?	Process
22	Have cost & schedule variations caused by rework been accurately recorded?	Process
23	Is there a process for monitoring results to see if they comply with quality standards?	Process

24	Have quality audits been used to identify lessons learned?	Process
25	Has the release of Work Packages to Work Package managers been well controlled?	Process
26	Has milestone reporting been used on this project?	Process
27	Is client acceptance of this phase documented?	Process
28	Have changes to scope been allowed only through scope change control process?	Process
29	Has the integrity of the performance measurement baseline been maintained?	Process
30	Has a configuration management system been used to control changes to key project items or systems?	Process
31	Have baselines been well maintained and effective change management processes operated?	Process
32	Have meetings of the PCB and other project reviews been action oriented to ensure proper control of the project?	Process
33	Is there an activity list, including activity descriptions?	Process
34	Is there a schedule for the project ?	Product
35	Do activity durations have the support of the people doing the work?	Product
36	Do activity duration estimates include an indication of the range of possible durations?	Process
37	Are activity durations based on historical information or documented experience?	Product
38	Is there a staffing management plan consistent with the project schedule?	Process
39	Do resource estimates specify types and quantities of resources for each work package?	Product
40	Do resource estimates have the support of the people responsible for doing the work?	Product
41	Are cost estimates based on structured labour rates including indirect costs?	Product
42	Is there a cost baseline?	Process
44	Does the planning process recognise the need for more detail on activities that are performed in the short term?	Process
45	Is the effort in planning balanced against its value for money and significance?	Process
46		Missing
47	Is scope defined by WBS used to define activities?	Process
48	Is there a process which identifies how procurement will be managed?	Process
49	Is there a procurement plan?	Process
50	Are procurement documents structured to facilitate complete & accurate responses from suppliers?	Product
51	Is there a Project Quality Management process?	Product
52	Does the quality plan describe how the quality policy will be implemented	Process
53	Does the QA process ensure increased effectiveness && efficiency of the project?	Product

54	Does the project team understand the characteristics of the deliverable that the project will create ?	Process
55	Is there a process for identifying features to be included in a deliverable created by the project?	Product
56	Are the constraints limiting the project team understood & assumptions documented?	Process
57	Does the project team understand the business justification for doing the project?	Product
58	Is there a process for refining the project deliverable ?	Product
60	Is there common language & terminology across the project organisation?	Process
61	Are mistakes tolerated, if the lessons are learned and processes improved?	Process
62	Is there a planning process integrating business and project planning?	Process
63	Is the value of project work recognised in the organisation and is it seen as a good career path?	Process
65	Are project roles & responsibilities assigned to stakeholders actively involved in the project?	Process
66	Is there a document that shows which organisational unit is responsible for which work items?	Product
67	Do the managers of the resources have a personal commitment to the success of the project?	Product
68	Is there a process for identifying potentially suitable and available staff?	Product
69	Have team building activities taken place?	Process
71	Does this project have its own reward & recognition system?	Process
72	To what extent is the project's reward & recognition system independent of the organisation's reward & recognition system?	Product
74	Is training available to the project team?	Process
75	Is there input from the project into the performance appraisal process?	Product
77	Does the project team have the authority to make all project decisions?	Process
78	Has the project retrieved lessons learned from previous projects and applied them to this one?	Product
79	Have the lessons learned been captured and communicated within the organisation?	Product
80	Is there a communication management plan?	Process
81	Is project information distributed to people who need it?	Product
82	Is there a process for reviewing performance and assessing status or progress ?	Product
83	Are performance reports provided by and to the project team?	Process
84	Is there a formal process for closing the project?	Product
85	Is there a process for selecting the right suppliers?	Process

Appendix P-7

Projects analysed in Chapter 5, Section 4.

Project	DCI Version	Industry	Company	Project Type	Perspective	Cost £'000	Dur'n (Weeks)
1	2	Tel	I	Other	Procure	£1,000.0	52.00
2	2	Tel	I	Other	I-H	£12,615.0	91.00
3	2	Tel	H	Hard Systems	I-H	£1,900.0	100.00
4	2	Tel	H	Hard Systems	I-H	£1,910.0	38.00
5	2	Tel	H	Hard Systems	I-H	£1,325.0	24.00
6	2	Tel	H	Hard Systems	Procure	£10,100.0	75.00
7	2	EPCM	T	Refurbishment	Procure	£400.0	30.00
8	2	EPCM	T	Other	Procure	£1,500.0	200.00
9	2	EPCM	T	Other	Procure	£9,953.0	136.00
10	2	EPCM	T	Construction	Procure	£1,552.0	52.00
11	2	EPCM	T	Construction	Procure	£4,330.0	75.00
12	2	EPCM	T	Refurbishment	Procure	£1,178.0	30.00
13	2	EPCM	T	Construction	Procure	£44,000.0	52.00
14	2	Tel	I	New Product	I-H	£245.0	52.00
15	2	EPCM	E	Construction	Procure	£4,800.0	64.00
16	2	EPCM	E	Construction	Procure	£27,900.0	192.00
17	2	EPCM	E	Refurbishment	Procure	£700.0	112.00
18	2	EPCM	E	Construction	Procure	£827.0	103.00
19	2	EPCM	E	Construction	Procure	£3,205.0	112.00
20	2	EPCM	E	Construction	Procure	£1,199.0	64.00
21	2	EPCM	E	Construction	Procure	£16,500.0	130.00
22	2	EPCM	E	Construction	Procure	£58,090.0	155.00
23	2	FS	A	Soft Systems	Procure	£470.0	60.00
24	2	FS	A	Soft Systems	I-H	£1,796.0	120.00
25	2	FS	A	Other	I-H	£3,500.0	80.00
26	2	FS	A	Soft Systems	Procure	£4,000.0	95.00
27	2	FS	A	New Product	Procure	£1,000.0	40.00
28	3	EPCM	B	Construction	Prime	£33,564.0	88.00
29	3	EPCM	B	Construction	Supply	£86,300.0	168.00
30	3	EPCM	B	Construction	Supply	£14,000.0	122.00
31	3	EPCM	B	Construction	Prime	£28,000.0	178.00
32	3	EPCM	B	Construction	Prime	£320,000.0	240.00
33	3	FS	C	Other	I-H	£3,102.0	60.00
34	3	FS	C	Other	Procure	£3,200.0	68.00
35	3	Tel	D	Hard Systems	Prime	£10,000.0	114.00
36	3	Tel	D	Hard Systems	Prime	£20,000.0	256.00
37	3	Tel	D	Hard Systems	Prime	£7,000.0	258.00
38	3	Tel	D	Hard Systems	Procure	£1,467.0	16.00
39	3	EPCM	F	Refurbishment	Procure	£29,000.0	64.00
40	3	EPCM	F	Construction	Procure	£12,400.0	57.00
41	3	EPCM	F	Refurbishment	Procure	£27,000.0	91.00
42	3	EPCM	F	Construction	Procure	£55,000.0	135.00
43	3	Misc	G	Hard Systems	I-H	£18,000.0	182.00

Project	DCI Version	Industry	Company	Project Type	Perspective	Cost £'000	Dur'n (Weeks)
44	3	Tel	H	Hard Systems	I-H	£1,500.0	21.00
45	3	Tel	H	Hard Systems	I-H	£161.0	62.00
46	3	Tel	H	Hard Systems	Procure	£3,482.0	45.00
47	3	Tel	I	New Product	Procure	£1,200.0	52.00
48	3	Tel	I	Other	I-H		
49	3	Tel	I	Other	Procure	£1,583.0	86.00
50	3	Misc	O	New Product	Supply		
51	3	Misc	O	Other	I-H	£75.0	64.00
52	3	Misc	O	New Product	Procure	£130.0	35.00
53	3	Misc	O	Refurbishment	Procure	£126.0	33.00
54	3	Misc	O	Soft Systems	Procure	£1,245.0	91.00
55	3	Misc	P	New Product	Prime	£1,500.0	75.00
56	3	Misc	P	New Product	Prime	£2,000.0	104.00
57	3	Misc	P	New Product	I-H	£575.0	53.00
58	3	Misc	P	New Product	Prime	£800.0	52.00
59	3	Misc	P	Other	I-H	£1,500.0	100.00
60	3	EPCM	Q	Construction	Procure	£136,300.0	155.00
61	3	EPCM	Q	Other	I-H	£2,050.0	90.00
62	3	EPCM	Q	Construction	Procure	£2,060.0	90.00
63	3	EPCM	Q	Construction	Procure	£61,600.0	81.00
64	3	EPCM	Q	Soft Systems	I-H		40.00
65	3	EPCM	Q	Other	I-H		160.00
66	3	EPCM	Q	Other	I-H	£9,300.0	80.00
67	3	Misc	R	New Product	I-H	£800.0	98.00
68	3	Misc	R	New Product	I-H	£900.0	104.00
69	3	Misc	R	New Product	I-H	£115.0	43.00
70	3	Misc	R	New Product	I-H	£5,800.0	208.00
71	3	Misc	R	New Product	I-H	£337.0	195.00
72	3	EPCM	S	Construction	Supply	£52,000.0	118.00
73	3	EPCM	S	Construction	Supply	£120,000.0	170.00
74	3	EPCM	S	Construction	Supply	£106,500.0	108.00
75	3	EPCM	S	Construction	Supply	£189,209.0	306.00
76	3	EPCM	T	Refurbishment	Procure	£1,340.0	156.00
77	3	EPCM	T	Refurbishment	Procure	£704.0	52.00
78	3	EPCM	T	Other	Procure	£40.0	29.00
79	3	EPCM	T	Refurbishment	Procure	£15,000.0	119.00
80	3	EPCM	T	Other	Procure	£500.0	14.00
81	3	EPCM	T	Other	Procure	£19,570.0	515.00
82	1	Misc	M	New Product	Prime	£178,461.0	159.00
83	1	EPCM	F	Construction	Procure	£27,570.0	108.00
84	1	EPCM	F	Refurbishment	Procure	£502.7	148.00
85	1	FS	N	Refurbishment	Procure	£720.9	103.00
86	1	FS	N	Hard Systems	Procure	£1,959.2	70.00
87	1	FS	N	Refurbishment	Procure	£755.1	201.00
88	1	FS	N	Refurbishment	Procure	£797.0	232.00
89	1	FS	C	New Product	Procure	£1,035.4	66.00
90	1	EPCM	E	Construction	Procure	£5,809.0	120.00
91	1	EPCM	E	Construction	Procure	£122.2	40.00
92	1	EPCM	L	Refurbishment	Procure	£1,593.1	85.00
93	1	Misc	G	Other	I-H	£47.4	21.00
94	1	FS	A	Soft Systems	I-H	£425.7	41.00
95	1	FS	A	Soft Systems	I-H	£1,022.0	48.00

Project	DCI Version	Industry	Company	Project Type	Perspective	Cost £'000	Dur'n (Weeks)
96	1	FS	A	Other	I-H	£5,534.0	47.00
97	1	Tel	I	Hard Systems	I-H	£2,438.6	131.00
98	1	Tel	I	Other	I-H	£12,615.0	91.00
99	1	Tel	H	Hard Systems	I-H	£2,114.0	139.00
100	1	Tel	H	Hard Systems	I-H	£1,666.0	68.00
101	1	Tel	C	Hard Systems	I-H	£100.0	75.00
102	1	Tel	C	Hard Systems	I-H	£312.0	18.00
103	1	Misc	J	Soft Systems	I-H	£450.0	114.00
104	1	Misc	K	Soft Systems	I-H	£1,435.6	60.00
105	1	Misc	K	Soft Systems	I-H	£9,937.5	84.00
106	1	EPCM	B	Construction	Prime	£1,000.0	520.00
107	3	Tel	H	Hard Systems	I-H	£12,400.0	62.00
108	3	Tel	H	Hard Systems	I-H	£30,000.0	104.00
109	3	Misc	P	New Product	Prime	£6,000.0	450.00
110	3	Misc	P	New Product	Prime	£2,400.0	75.00
111	3	Misc	P	New Product	Prime	£2,200.0	82.00
112	3	EPCM	T	Construction	Procure	£5,600.0	150.00
113	3	EPCM	T	Hard Systems	Procure	£7,000.0	65.00
114	3	FS	U	Soft Systems	I-H	£114,800.0	128.00
115	3	FS	U	Soft Systems	I-H	£2,423.0	156.00
116	3	FS	U	Soft Systems	I-H	£26,000.0	65.00
117	3	FS	U	Hard Systems	I-H	£4,642.0	23.00
118	3	FS	U	Other	I-H		
119	3	FS	U	Soft Systems	I-H	£11,800.0	87.00
120	3	FS	U	Soft Systems	I-H	£464.0	26.00
121	3	FS	U	Soft Systems	I-H	£3,420.0	78.00
122	3	FS	U	Soft Systems	I-H	£200.0	22.00
123	3	FS	U	Soft Systems	I-H	£650.0	52.00
124	3	FS	U	Hard Systems	Procure	£9,900.0	51.00
125	3	FS	U	Hard Systems	I-H	£10,750.0	30.00
126	3	FS	U	Other	I-H	£10,349.8	46.00
127	3	FS	U	Other	I-H	£948.0	104.00
128	3	FS	U	Soft Systems	I-H	£125.0	59.00
129	3	FS	U	Soft Systems	I-H	£700.0	40.00
130	3	FS	U	Soft Systems	I-H	£4,400.0	40.00
131	3	FS	U	Hard Systems	I-H	£1,300.0	21.00
132	3	FS	V	Other	I-H	£302.0	40.00
133	3	FS	V	Soft Systems	I-H	£834.0	48.00
134	3	FS	V	Soft Systems	I-H	£776.0	36.00
135	3	FS	V	Soft Systems	I-H	£146.0	37.00
136	3	FS	U	Soft Systems	I-H	£1,900.0	52.00

Appendix P-8

Analysis of Variance for Significant Project Management Practices

Question	Dependent Variable = Time Predictability						
	One-Way ANOVA						Kruskal-Wallis
		Sum of Squares	df	Mean Square	F	Sig.	Sig.
P2	Between Groups	1.8554	3	0.6185	5.9223	0.0009	0.0004
	Within Groups	10.0256	96	0.1044			
	Total	11.8811	99				
2M	Between Groups	1.2966	3	0.4322	3.9199	0.0109	0.1135
	Within Groups	10.5845	96	0.1103			
	Total	11.8811	99				
2C	Between Groups	1.6198	5	0.3240	2.9677	0.0157	0.0035
	Within Groups	10.2613	94	0.1092			
	Total	11.8811	99				
3C	Between Groups	1.2542	5	0.2508	2.2188	0.0588	0.1147
	Within Groups	10.6269	94	0.1131			
	Total	11.8811	99				
5	Between Groups	1.2088	3	0.4029	3.6246	0.0158	0.0045
	Within Groups	10.6722	96	0.1112			
	Total	11.8811	99				
6	Between Groups	1.4974	3	0.4991	4.6145	0.0046	0.0070
	Within Groups	10.3837	96	0.1082			
	Total	11.8811	99				
7	Between Groups	1.7321	3	0.5774	5.4613	0.0016	0.0024
	Within Groups	10.1490	96	0.1057			
	Total	11.8811	99				
12M	Between Groups	1.3067	3	0.4356	3.9544	0.0105	0.0344
	Within Groups	10.5743	96	0.1101			
	Total	11.8811	99				
31M	Between Groups	1.2235	3	0.4078	3.6736	0.0149	0.0027
	Within Groups	10.6576	96	0.1110			
	Total	11.8811	99				
66	Between Groups	1.2660	3	0.4220	3.8164	0.0124	0.0035
	Within Groups	10.6151	96	0.1106			
	Total	11.8811	99				
Dur'n	Between Groups	1.7321	3	0.5774	5.4613	0.0016	Not relevant
	Within Groups	10.1490	96	0.1057			
	Total	11.8811	99				

Question	Dependent Variable = Cost Predictability						
	One-Way ANOVA						Kruskal-Wallis
28C	Between Groups	0.5966	5	0.1193	4.1768	0.0018	0.2111
	Within Groups	2.6282	92	0.0286			
	Total	3.2248	97				
29C	Between Groups	0.3662	5	0.0732	2.3574	0.0463	0.7062
	Within Groups	2.8586	92	0.0311			
	Total	3.2248	97				

Appendix P-9

Organizations that have contributed to the research through membership of project management knowledge networks.

Astrium Limited

Abbott Laboratories

Anglian Water plc

AstraZeneca

Australian Department of Defense – Defense Acquisition Organization

Australian Water Technologies

Automobile Association

BAE Systems

Balfour Beatty*

BHP Information Technology

Boehringer Ingelheim*

BP Oil Europe*

Bristol-Myers Squibb

British Gas Trading Ltd

BT Projects Group

Cable & Wireless

Cable & Wireless Optus

Coles Myer Limited

Colonial Australian Financial Services

Com Tech Communications

Ericsson Australia

ETSA Utilities*

Fujitsu Systems*

Genzyme Corporation

GlaxoWellcome R&D

Halifax plc

Hewlett Packard Consulting

IBM Global Services Australia

ICL*

Kvaerner Construction*

Lloyds TSB

London Underground Infracos

Main Roads – Queensland

Merck and Co Inc

Motorola Electronics

Nationwide Building Society

NatWest Group*

Nortel Networks Ltd

Novo Nordisk A/s

NSW Department of Public Works

Nycomed Amersham Plc

Perkin-Elmer

Pfizer Limited

Pharmacia Corp

Post Office Consulting

Project Services (Queensland) - Department of Public Works

Qantas Airways

QBE Insurance

Queensland Rail

Racal Radar*

Rail Services Australia

Railtrack*

Resitech

Sinclair Knight Merz

SmithKline Beecham

Telstra

Thames Water Utilities

Westinghouse Brake*

Note:

Organisations denoted with an asterisk (*) are no longer active members of the networks at the time of submitting this thesis.

Towards Improved Project Management Practice

Appendices (Landscape)

Appendix L-1:

Analysis of Project Management Articles in Professional Journals – 1984 to 1998

	Knowledge element	IJPM 84-98	IJPM 84-88	IJPM 89-93	IJPM 94-98	% 84-98	% in last third	Growth factor	IJPM 90-98	PMJ 90-98	US/UK bal
1	Business need & case	1	0	1	0	0%	0%	-36%	1	0	0%
2	Marketing and sales	4	1	3	0	1%	0%	-36%	3	5	269%
3	Goals, objectives & strategy	28	7	14	7	5%	25%	-11%	14	5	58%
4	Strategic implementation plan	11	4	6	1	2%	9%	-27%	6	2	54%
5	Project appraisal	20	5	8	7	4%	35%	-1%	13	10	124%
6	Financial management	21	12	4	5	4%	24%	-12%	9	3	54%
7	Systems management	21	6	9	6	4%	29%	-7%	13	4	50%
8	Project management	148	56	56	36	28%	24%	-12%	72	26	58%
9	Programme management	12	1	3	8	2%	67%	31%	11	3	44%
10	Project life cycles	13	2	5	6	2%	46%	10%	10	5	81%
11	Integrative management	6	3	1	2	1%	33%	-3%	3	5	269%
12	Project context	26	6	12	8	5%	31%	-5%	18	2	18%
13	Requirements management	13	4	4	5	2%	38%	2%	8	1	20%
14	Design management	9	4	2	3	2%	33%	-3%	5	3	97%
15	Project management plan	48	14	20	14	9%	29%	-7%	31	2	10%
16	Success criteria	18	2	4	12	3%	67%	31%	15	7	75%
17	Project launch	12	3	7	2	2%	17%	-19%	7	0	0%
18	Work management	20	6	6	8	4%	40%	4%	13	9	112%

	Knowledge element	IJPM 84-98	IJPM 84-88	IJPM 89-93	IJPM 94-98	% 84-98	% in last third	Growth factor	IJPM 90-98	PMJ 90-98	US/UK bal
19	Schedule management	52	15	15	22	10%	42%	6%	37	25	109%
20	Resources management	19	11	3	5	4%	26%	-10%	8	16	323%
21	Cost management	28	16	7	5	5%	18%	-18%	10	14	226%
22	Risk management	65	8	22	35	12%	54%	18%	57	14	40%
23	Value improvement	3	0	0	3	1%	100%	64%	3	1	54%
24	Quality management	23	3	11	9	4%	39%	3%	18	7	63%
25	Safety, health and environment	4	1	2	1	1%	25%	-11%	3	2	108%
26	Project organisation	52	14	15	23	10%	44%	8%	37	14	61%
27	Project monitoring and control	35	8	11	16	7%	46%	10%	23	17	119%
28	Performance measurement	19	4	8	7	4%	37%	1%	14	11	127%
29	Configuration management and change control	14	1	3	10	3%	71%	35%	13	3	37%
30	Information management	95	26	34	35	18%	37%	1%	58	29	81%
31	Procurement	7	2	3	2	1%	29%	-7%	5	8	258%
32	Supply chain management and logistics	3	1	0	2	1%	67%	31%	2	4	323%
33	Purchasing	1	0	0	1	0%	100%	64%	1	0	0%
34	Contract planning and administration	47	15	17	15	9%	32%	-4%	27	17	102%
35	Legal awareness	8	4	2	2	1%	25%	-11%	4	6	242%
36	Teamwork	19	2	8	9	4%	47%	11%	15	12	129%
37	Leadership	17	1	6	10	3%	59%	23%	16	10	101%
38	Conflict management	6	1	1	4	1%	67%	31%	5	2	65%
39	Stress management	2	0	0	2	0%	100%	64%	2	0	0%
40	Personnel management	35	11	14	10	7%	29%	-7%	18	11	99%
41	Industrial relations	2	1	0	1	0%	50%	14%	1	2	323%
42	Testing, commissioning and hand-over/acceptance	1	1	0	0	0%	0%	-36%	0	0	100%
43	Project close out	0	0	0	0	0%	0%	0%	0	0	100%
44	(Post-) project evaluation review	7	1	3	3	1%	43%	7%	4	3	121%

Source of data: {Themistocleous & Wearne 2000 #310}

The selection of the 44 specific topics, and the definition of each, was carried out by the authors of the article cited.

Appendix L-2

The Action Research Programme – Year by Year

Period	Network Activities	Instruments Developed	Research Methods & Principles	Number of Members
Jan '94 to March '95	▪ Formation ▪ Choice of topics ▪ Enterprise capability analysis ▪ Workshops on 5 topics ▪ Customer satisfaction survey	▪ Corporate practice questionnaire (CPQ) v1 ▪ Best practice guides ▪ Best practice spreadsheet	▪ Exploratory analysis ▪ Qualitative text analysis ▪ Quantitative numerical analysis ▪ Qualitative ► Quantitative work on best practice guides.	▪ 15 in Europe 1
April '95 to March '96	▪ System Dynamics workshop ▪ Development of project-level database ▪ Presentation of pilot results ▪ 4 workshops on topics of choice ▪ Formation of 2nd network (Europe 2) ▪ Presentation of final results	▪ Project database v1	▪ Grounded theory to construct SD model and database ▪ Qualitative ► Quantitative transformation of project-level data. ▪ Statistical analysis of project-level data.	▪ 15 in Europe 1 ▪ 10 in Europe 2
April '96 to March '97	▪ Europe 1 add a few more projects to database. ▪ Enterprise capability report to both networks. ▪ Workshops on topics of choice. ▪ Working party (WP) on Learning Lessons on Projects. ▪ WPs initiated on "Real Risk Management" and a new Project-level database tool (Data Collection Instrument Mk 2) ▪ Supplementary analysis of both databases	▪ CPQ v2 ▪ "Learning lessons on projects" kit.	▪ Qualitative text analysis of CPQ. ▪ Quantitative numerical analysis of CPQ. ▪ Qualitative ► Quantitative transformation of project-level data. ▪ Statistical analysis of project-level data.	▪ 13 in Europe 1 ▪ 10 (later 8) in Europe 2

Period	Network Activities	Instruments Developed	Research Methods & Principles	Number of Members
April '97 to March '98	▪ 5 workshops for E1 ▪ 7 workshops for E2 ▪ WP develops DCI Mk2 v1 ▪ WP reports on "Real risk management" ▪ Analysis of 25 projects collected with DCI Mk2	▪ DCI Mk2 v1 ▪ "Real risk management" kit	▪ Grounded theory development of DCI Mk2. ▪ Quantitative analysis of DCI Mk2 output.	▪ 12 in Europe 1 ▪ 8 in Europe 2
April '98 to March '99	▪ Analysis of 80 and 110 projects ▪ Development of CPQ v3 ▪ WP Develops DCI Mk2 v2 ▪ 3 joint workshops ▪ 2 workshops each for Europe 1 & 2 ▪ WP on "Measuring project performance" ▪ WP initiated on "Implementing project improvements" ▪ Addition of 2 new networks.	▪ DCI Mk2 v2 ▪ CPQ v3 ▪ "Measuring project performance" kit	▪ Grounded theory development of CPQ v3 ▪ Quantitative analysis of DCI Mk2 output. ▪ Grounded theory development of "Value added" measure for project management. ▪ Further Qualitative ► Quantitative transformation of project-level data, to integrate project-level database v1 with DCI Mk2 data.	▪ 11 in Europe 1 ▪ 8 in Europe 2 ▪ 6 in Pharma 1 ▪ 8 in Pacrim 1
April '99 to March '00	▪ 6 workshops for Europe 1 and 2 ▪ 2 2-day workshops for Pharma 1 ▪ 7 workshops for Pacrim 1 ▪ 2 workshops for Pacrim 2 ▪ Pharma WP on "Human Factors" ▪ Pacrim1 WP on "measuring project performance". ▪ Addition of new network	▪ Application of existing tools. ▪ "Implementing process improvements" kit.	▪ Multiple combination of data from CPQ and from DCI in order to illuminate specific topics.	▪ 18 members in Europe 1 & 2 combined. ▪ 13 in Pharma 1 ▪ 15 in Pacrim 1 ▪ 15 in Pacrim 2.

Appendix L-3

Raw data from which calculations of significance have been made.

Project	DCI Version	Cpred	Tpred	Ctpred	Spred	MAKPE	P2N	Q2M	Q5	Q6	Q7	Q12M	Q16M	Q31M	Q65	Q66	Q2C	Q3C	Q16C	Q28C	Q29C	Q47C
34	3	1.00	1.31	1.31		5	1	3	2	2	1	3	3	1	3	3	3	3	3	1	1	3
35	3	1.25	1.10	1.37		15	3	2	3	2	3	2	3	4	4	3	3	3	4	5	3	5
36	3	1.67	1.71	2.84		13	2	2	3	2	2	3	3	2	3	3	2	3	4	2	2	3
37	3	1.00	1.03	1.03		8	2	3	2	3	3	3	2	2	2	3	2	3	3	2	5	3
38	3	1.20	1.00	1.20		16	1	1	2	1	1	1	3	3	2	3	3	3	3	4	4	2
39	3	.94	.98	.92		19	3	3	4	4	4	4	4	4	4	4	5	5	6	6	5	5
40	3	.80	.95	.76		19	2	2	3	2	2	3	4	4	4	4	3	3	5	6	6	5
41	3	.90	1.00	.90		19	4	3	4	4	4	4	4	4	4	4	5	5	5	5	5	6
42	3	.87	.97	.85		19	2	2	2	2	2	2	4	4	4	4	3	3	5	5	5	5
43	3	1.00	1.00	1.00	1.0	13	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
44	3	1.00	1.31	1.31		10	3	2	1	1	1	2	2	1	4	1	2	2	4	2	2	4
45	3	1.21	1.19	1.44		17	2	4	3	2	3	4	3	3	3	4	5	4	4	5	4	5
46	3	1.06	1.00	1.06		13	3	3	2	1	2	3	3	4	4	4	4	4	4	5	3	5
47	3	1.00	1.00	1.00		15	2	3	2	4	2	3	4	3	3	4	1	1	1	3	1	4
48	3						3	3	1	1	1	3	1	1	3	2	2	2	1	1	1	2
49	3	1.06	1.10	1.16		8	2	4	4	1	1	4	4	4	3	4	1	4	4	4	4	5
50	3					13	1	1	1	1	1	1	1	1	2	2	1	1	1	1	1	1
51	3	1.00	2.29	2.29		7	1	2	1	1	1	1	1	1	2	1	1	1	1	1	1	1
52	3	1.00	1.09	1.09			1	2	1	2	3	2	4	1	3	1	2	3	4	3	1	4
53	3	.98	1.32	1.29			2	3	2	1	1	1	4	1	3	1	4	4	4	4	1	4
54	3	1.04	2.33	2.43			1	3	1	2	1	3	4	3	3	2	4	4	4	6	4	4
55	3	1.00	1.00	1.00		10	4	3	4	4	3	2	4	2	4	3	4	4	5	4	4	5
56	3	1.00	.87	.87		11	4	4	3	4	4	3	4	4	4	4	4	4	5	4	4	4
57	3	1.00	.88	.88		12	4	4	4	4	4	4	4	4	4	4	4	3	4	1	4	4
58	3	1.00	1.00	1.00		8	4	4	4	4	3	2	4	3	4	4	4	4	4	4	4	4
59	3	1.00	1.00	1.00		10	4	4	2	4	3	4	4	3	3	3	4	4	4	4	1	4
60	3	1.01	1.05	1.06		19	1	1	1	1	1	1	3	3	3	3	1	1	5	5	1	5
61	3	.93	1.00	.93		2	2	2	2	2	2	3	4	4	4	4	2	2	5	4	4	3
62	3	.98	1.00	.98		2	2	2	2	2	2	3	4	4	4	4	2	2	5	4	4	3
63	3	1.16	1.04	1.21			2	4	4	4	3	4	4	4	4	4	4	4	4	4	4	4
64	3		1.00			8	3	3	1	1	1	2	4	3	3	3	2	1	2	1	1	3
65	3		2.46			18	3	1	2	1	1	1	3	1	3	1	1	1	2	1	1	3
66	3	1.03	1.07	1.10	1.1																	
67	3	1.00	2.04	2.04	1.0	19	1	2	3	2	2	2	3	3	3	3	3	3	5	5	4	5
68	3	1.00	1.33	1.33	1.0	19	1	2	2	2	2	2	3	2	3	3	3	3	5	5	4	5

Project	DCI Version	Cpred	Tpred	Ctpred	Spred	MAKPE	P2N	Q2M	Q5	Q6	Q7	Q12M	Q16M	Q31M	Q65	Q66	Q2C	Q3C	Q16C	Q28C	Q29C	Q47C
69	3	.92	1.23	1.13	1.0	19	1	2	2	2	2	2	3	3	3	3	3	3	5	5	4	5
70	3	1.00	1.00	1.00	1.0	11	2	4	4	4	4	2	3	3	3	3	5	5	5	4	4	4
71	3	1.00	1.15	1.15	1.0	7	2	3	2	2	3	3	4	2	3	3	5	5	5	5	5	5
72	3	1.08	1.07	1.16		15	2	4	3	4	4	2	4	3	4	4	5	4	6	5	5	4
73	3	1.00	1.00	1.00		6	2	4	2	4	2	3	4	4	3	4	5	5	4	5	5	5
74	3	1.00	1.00	1.00		16	2	3	4	3	4	3	4	4	3	4	4	4	5	5	5	5
75	3	1.27	.96	1.21		15	2	2	3	1	1	2	4	3	3	4	4	4	5	5	4	4
76	3	1.00	1.50	1.50		17	3	2	1	2	2	2	2	3	3	3	3	1	3	5	5	3
77	3	1.00	1.00	1.00		17	4	2	4	2	2	4	4	4	4	4	4	3	6	6	6	2
78	3	2.00	.45	.91		13	4	4	4	4	4	4	4	4	4	4	4	4	5	1	1	3
79	3	1.00	1.00	1.00		17	3	4	3	2	2	3	4	2	3	4	5	3	5	5	4	4
80	3	.96	.70	.67		13	3	3	3	3	3	3	4	3	3	4	4	3	5	4	4	4
81	3	1.00	2.45	2.46		5	1	2	2	1	1	3	3	3	4	4	2	2	4	4	4	4
82	1	1.16	1.05	1.22	1.0	19																
83	1	.74	.84	.62	1.1	19																
84	1	1.19	1.18	1.41	1.0	19																
85	1	.89	1.00	.89	1.1	19																
86	1	1.00	.84	.85	1.1	19																
87	1	1.07	1.01	1.07	1.0	19																
88	1	.96	2.23	2.15	1.0	19																
89	1	1.04	.87	.90	1.0	19																
90	1	1.06	2.67	2.83	1.0	19																
91	1	1.01	.95	.97	1.0	19																
92	1	1.24	1.10	1.37	1.0	19																
93	1	1.05	1.00	1.05	1.0	19																
94	1	1.49	2.73	4.07	1.0	19																
95	1	1.23	1.33	1.64	0.8	19																
96	1	1.05	1.07	1.13	1.0	19																
97	1	.43	.90	.39	0.8	19																
98	1	.89	1.25	1.11	0.9	19																
99	1	1.07	1.23	1.32	1.2	19																
100	1	1.12	1.08	1.21	1.0	19																
101	1	.82	1.06	.87	0.9	19																
102	1	.56	.90	.51	1.0	19																
103	1	1.67	4.38	7.31	1.0	19																

Project	DCI Version	Cpred	Tpred	Ctpred	Spred	MAKPE	P2N	Q2M	Q5	Q6	Q7	Q12M	Q16M	Q31M	Q65	Q66	Q2C	Q3C	Q16C	Q28C	Q29C	Q47C
104	1	1.04	1.00	1.04	1.0	19																
105	1	1.23	1.24	1.52	1.0	19																
106	1	1.14	1.34	1.53	1.0	19																
107	3	.90	1.38	1.24	1.1																	
108	3	1.00	1.00	1.00	1.0																	
109	3	1.50	1.50	2.25	1.3																	
110	3	1.00	1.00	1.00	1.1																	
111	3	1.00	1.11	1.11	1.0																	
112	3	1.00	1.00	1.00	1.1																	
113	3	1.00	1.00	1.00	1.0																	
114	3	1.00	1.00	1.00	1.0	19	2	2	4	4	4	3	4	4	4	4	3	3	6	5	5	2
115	3	1.00	1.00	1.00	1.0	18	3	4	4	4	4	3	4	3	4	4	6	6	6	6	6	4
116	3	1.00	1.00	1.00	1.0	12	3	3	3	2	4	4	4	4	3	4	3	3	4	4	4	1
117	3	.93	1.35	1.26	1.0	17	3	3	3	3	2	3	3	2	3	4	4	4	3	4	2	4
118	3					19	2	2	4	4	4	3	3	1	3	3	3	4	3	4	2	3
119	3	1.30	1.12	1.45	1.0	6	2	2	3	4	4	4	3	3	3	3	3	4	4	6	4	3
120	3	1.00	1.00	1.00	1.0	7	1	2	2	2	2	4	4	3	3	2	3	3	4	1	1	2
121	3	.95	1.00	.95	1.3	19	3	3	2	3	2	2	3	3	3	3	3	3	3	4	2	1
122	3	1.00	1.10	1.10	1.0	19	2	2	1	1	1	3	3	3	4	4	2	2	4	4	4	4
123	3	1.00	1.00	1.00	1.0	11	2	3	2	3	3	3	4	4	3	4	3	3	3	4	4	4
124	3	1.02	1.00	1.02	1.0	13	3	4	3	4	3	3	4	4	3	3	4	4	4	3	5	4
125	3	.98	1.00	.98	1.0	16	3	3	4	4	4	4	4	3	4	4	5	5	5	5	5	4
126	3	1.03	.77	.79	1.0	18	3	4	4	4	4	3	4	2	4	4	6	6	5	5	1	1
127	3	1.00	1.00	1.00	1.0	13	2	2	2	2	2	2	3	1	3	3	3	3	4	1	5	3
128	3	.88	.94	.82	1.0	13	2	2	3	2	3	3	3	2	4	4	3	3	4	2	3	4
129	3	1.00	1.00	1.00	1.0	19	2	3	3	3	3	2	3	3	3	3	3	3	4	5	4	3
130	3	.64	1.00	.64	0.8	17	3	4	3	2	2	4	4	3	3	4	5	5	4	3	3	1
131	3	1.00	1.00	1.00	1.0	12	3	3	4	4	2	2	4	3	3	4	3	3	3	3	3	3
132	3	1.00	1.00	1.00	1.0	13	2	3	4	4	3	3	3	3	3	3	3	3	3	2	3	3
133	3	1.00	1.00	1.00	1.0	13	2	3	3	4	3	4	4	3	3	2	4	4	4	3	3	3
134	3	1.00	1.00	1.00	1.0	13	2	3	4	4	3	3	3	3	3	3	3	4	3	4	3	3
135	3	1.00	1.00	1.00	1.0	12	2	3	2	3	3	3	3	3	3	3	3	3	3	2	2	2
136	3	.68	1.00	.68	0.9	19	3	4	3	3	2	2	3	2	3	2	4	4	4	3	3	4

Appendix L-4

Significant correlations in the DCI data set.

		Cost	Time	Cost & Time	Scope	Overall-1	Overall-2	Band-1	Band-2
P2N	Pearson Correlation	-0.0396	*-0.3136*	*-0.3462*	0.1063	0.3463	0.2259	0.2421	0.2492
	Sig. (2-tailed)	0.6984	*0.0015*	*0.0005*	0.5497	0.0448	0.0253	0.0163	0.0134
	N	98	*100*	*98*	34	34	98	98	98
Q2M	Pearson Correlation	-0.0616	*-0.3279*	*-0.2825*	0.0104	0.3061	0.1947	0.1930	0.1598
	Sig. (2-tailed)	0.5471	*0.0009*	*0.0048*	0.9533	0.0783	0.0547	0.0569	0.1161
	N	98	*100*	*98*	34	34	98	98	98
Q5	Pearson Correlation	0.0935	*-0.3128*	-0.2345	-0.1341	-0.0013	0.0668	0.1336	0.1123
	Sig. (2-tailed)	0.3598	*0.0015*	0.0201	0.4495	0.9941	0.5134	0.1897	0.2708
	N	98	*100*	98	34	34	98	98	98
Q6	Pearson Correlation	-0.0068	*-0.3524*	*-0.3026*	-0.2240	-0.0578	0.0754	0.1485	0.1366
	Sig. (2-tailed)	0.9469	*0.0003*	*0.0025*	0.2028	0.7455	0.4606	0.1444	0.1797
	N	98	*100*	*98*	34	34	98	98	98
Q7	Pearson Correlation	0.0254	*-0.3626*	*-0.2976*	-0.2308	-0.1396	0.0436	0.1076	0.1152
	Sig. (2-tailed)	0.8038	*0.0002*	*0.0029*	0.1891	0.4309	0.6700	0.2917	0.2588
	N	98	*100*	*98*	34	34	98	98	98
Q12M	Pearson Correlation	0.0156	*-0.2684*	-0.1827	-0.2658	-0.1021	0.0722	0.0833	0.0670
	Sig. (2-tailed)	0.8791	*0.0069*	0.0718	0.1286	0.5656	0.4799	0.4150	0.5119
	N	98	*100*	98	34	34	98	98	98
Q16M	Pearson Correlation	-0.0619	-0.1948	-0.1941	*-0.5815*	-0.3716	-0.1169	0.0245	-0.0522
	Sig. (2-tailed)	0.5445	0.0521	0.0555	*0.0003*	0.0305	0.2515	0.8106	0.6095
	N	98	100	98	*34*	34	98	98	98
Q31M	Pearson Correlation	-0.0892	*-0.2807*	-0.2551	-0.2091	-0.1244	0.1724	0.1608	0.1661
	Sig. (2-tailed)	0.3823	*0.0047*	0.0112	0.2353	0.4832	0.0895	0.1137	0.1022
	N	98	*100*	98	34	34	98	98	98
Q65	Pearson Correlation	0.0100	-0.1384	-0.1232	*-0.4849*	-0.3841	-0.0443	0.1430	0.0771
	Sig. (2-tailed)	0.9225	0.1696	0.2267	*0.0037*	0.0249	0.6646	0.1602	0.4508
	N	98	100	98	*34*	34	98	98	98
Q66	Pearson Correlation	0.0250	*-0.3074*	-0.1902	-0.0453	-0.0824	0.1345	0.1851	0.1372
	Sig. (2-tailed)	0.8070	*0.0019*	0.0606	0.7992	0.6431	0.1867	0.0680	0.1779
	N	98	*100*	98	34	34	98	98	98

Table 1: Correlations between the adequacy of project management practices and project performance measures.

		Cost	Time	Cost & Time	Scope	Overall-1	Overall-2	Band-1	Band-2
Q2C	Pearson Correlation	-0.0559	*-0.2875*	-0.2407	-0.0461	0.1371	0.1179	0.1184	0.1098
	Sig. (2-tailed)	0.5847	*0.0037*	0.0169	0.7957	0.4395	0.2477	0.2457	0.2817
	N	98	*100*	98	34	34	98	98	98
Q3C	Pearson Correlation	-0.0420	*-0.2731*	-0.2252	-0.0647	0.0997	0.0877	0.0833	0.0720
	Sig. (2-tailed)	0.6817	*0.0060*	0.0258	0.7163	0.5749	0.3904	0.4147	0.4811
	N	98	*100*	98	34	34	98	98	98
Q16C	Pearson Correlation	-0.0126	-0.1209	-0.0653	*-0.5120*	-0.3222	-0.1144	0.0266	-0.0077
	Sig. (2-tailed)	0.9020	0.2310	0.5231	*0.0020*	0.0631	0.2620	0.7946	0.9404
	N	98	100	98	*34*	34	98	98	98
Q28C	Pearson Correlation	*-0.2735*	-0.0150	-0.0648	-0.0392	-0.1681	0.0710	0.0041	0.0204
	Sig. (2-tailed)	*0.0064*	0.8825	0.5261	0.8259	0.3419	0.4872	0.9678	0.8416
	N	*98*	100	98	34	34	98	98	98
Q29C	Pearson Correlation	*-0.2609*	-0.0630	-0.1069	-0.0522	-0.0509	0.1565	0.1504	0.1886
	Sig. (2-tailed)	*0.0095*	0.5333	0.2947	0.7693	0.7748	0.1238	0.1393	0.0629
	N	*98*	100	98	34	34	98	98	98
Q47C	Pearson Correlation	-0.1924	0.0236	-0.0599	-0.3301	*-0.4635*	-0.0854	-0.0291	-0.0785
	Sig. (2-tailed)	0.0577	0.8157	0.5578	0.0566	*0.0058*	0.4032	0.7757	0.4420
	N	98	100	98	34	*34*	98	98	98

Table 2: Correlations between the maturity of practices and project performance measures.